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An analysis of commodity aid and policies to eliminate its negative effects upon the commercial market

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An analysis of commodity aid and policies to eliminate its negative effects upon the commercial market

by

Jerry Allen Fedeler

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CHAPTER I. INTRODUCTION

Special Problems of Commodity Aid

Great interest in the economic development of all countries has evolved during the last quarter century. The uneven economic levels of living among the rich and poor nations triggered international concern and in turn spurred richer countries to offer poorer ones aid. During the same period of time, the United States has been politically burdened by surplus agricultural products. Since the U. S. is a wealthy nation, it has sought a solution to its domestic farm problem and simultaneously sought world approval by giving agricultural commodities to poorer nations.

However, aid in commodity form creates special problems. The recipient is forced to somehow distribute the particular aid product. Re-exporting the commodity aid is generally prohibited by accepted regulations of international trade. Therefore, the recipient must utilize all of it domestically. If the recipient allows the aid to only displace commercial imports, he transmits his problem to a third country. His own country suffers little if any loss but repercussions of this shift may be undesirable for many nations including the donor. On the other hand if aid displaces the recipient's domestic production or simply lowers the market price of the commodity received as aid, it imposes losses on some of the recipient's own nationals. These losses are likewise undesirable as they may retard the recipient's own development. For example, if India receives food aid and the domestic price of food is lowered, its own agricultural growth may be slowed. The imposition of losses may also make the net benefits of the aid questionable and prevent

the attainment of a pareto optimum with respect to the aid. A pareto optimum means that some individuals in the recipient country benefit while no one in that country or third countries suffers a loss. Finally, the losses may result in an undesirable income redistribution. All of these problems arise from the impact of aid on the commercial market. Therefore, they are referred to as the negative impacts of aid on the commercial market.

Foreign aid which is not restricted to a particular commodity does not generally create these problems. Non-restricted aid can be used by the recipient for whatever commodities are needed. Increased demands resulting from the greater income caused by the aid will determine those commodities. The only commercial markets which then experience negative impacts are the ones whose commodities have a negative shift in demand when the recipient's income rises.

Aid tied to a particular donor is likely to increase the negative effects on the commercial market. The recipient may not purchase from the donor those goods he would buy were he free to spend wherever he pleased. Instead he will purchase what the donor produces most competitively in an attempt to maximize his benefits. But these purchases will likely reduce the recipient's commercial purchases and hence losses will be imposed through the commercial market.

The more conditions on the form and source of the aid, the greater the likelihood that the aid will impose negative effects upon the commercial market. Aid in the form of commodities which have a well established market in the recipient country may impose large negative impacts through the commercial market. In contrast, aid in the form

of commodities which the recipient would neither buy without the aid nor buy if the aid were unconditional may impose no losses through the commercial market. Food commodities will generally be in the former class. They will compete with the commercial markets and thus impose losses.

Unfortunately the negative impacts of commodity aid on the commercial market go beyond that commercial market. The domestic and international markets of all goods are in general interdependent. An impact on one causes impacts on others. For a given commodity the displacement of commercial sales by aid causes the commercial producers to change their demands. This causes the commercial sales of other goods to change and their producers in turn change their demands. These multi-stepped impositions can result in further retardation of development, reduction of the net benefits of aid, and undesirable income redistributions.

Foreign aid, restricted or unrestricted with respect to commodity form, affects monetary conditions through terms of trade. Additional monetary effects may be caused by commodity aid. The depressing effect on sales in the commercial market of the aid commodity results in a lower price for that commodity. Its reduced quantity and lower price in turn impose negative effects on the suppliers of its inputs and cause their prices to also fall. At the same time the prices of those goods which are in greater demand are likely to rise. The net monetary effect of these price changes is not well understood. Monetary conditions are also associated with real output and employment (68, pp. 5-12). It is well known that changes in monetary conditions can likewise change real income distribution through changes in prices. Consequently,

countries try to maintain an optimum monetary condition to achieve their national goals for growth, development, income distribution, etc. Unless the monetary effects of aid are understood and can be taken into account, these national goals may not be attained.

In summary, foreign aid when given in the form of a particular commodity yields special results which are generally judged undesirable. These results are transmitted through the commercial market. It is the purpose of this study to investigate these undesirable results of commodity aid and propose methods to alleviate or eliminate them.

Negative Views on Commodity Aid

Most commodity aid studies concern P.L. 480 aid from the U. S. because that is by far the largest source (50, p. 76). These studies have concentrated upon food commodities. The criticisms of the negative effects of commodity aid which have appeared time and time again in the past studies can be classified as one of three types. The first is that the aid displaces commercial production either by reducing the recipient's domestic production or decreasing his commercial imports. The second is that commodity aid does not provide as much aid as a similar quantity of dollar aid. The third is the potential of undesirable monetary effects imposed on the recipient.

Other criticisms derive from the way the commodity aid has been utilized. Three examples follow. First, when food aid is distributed through the commercial market, it doesn't reach the poor (45, p. 69). Second, the sale proceeds of the aid have not been well invested or have not been invested at all but rather allowed to accumulate (45, p. 69).

Finally, food aid may be considered to be a substitute for dollar aid (45, p. 70). Even though aid is inefficiently or inequitably used, such criticisms in themselves are not directed toward the negative impacts of aid. Rather they are comments on the failure to achieve specific gains with the aid.

Most studies have viewed the impact of commodity aid on the commercial market by comparing changes in price and quantity variables over time. They compare the price and quantity of domestic production and commercial imports for a period prior to the aid with those during a period of aid. Such an approach is limited because it is not clear that all the changes which occurred were due to the aid.

The two studies by Mann (43) and Rogers (56) improve the analysis by isolating the negative effects of aid. Both studies relate to cereals in India. Mann develops a model with six equations encompassing domestic supply, demand, level of per capita income, commercial imports, changes in stocks, and market clearing (43, p. 132). He reached the following conclusion:

> The import of cereals under P.L. 480 lowers the price of cereals and leads to a decline in supply of cereals from domestic production. However, the decline in domestic supply is always less than the quantity imported and there is a net contribution to consumption (43, p. 144).

Rogers' study is based on Fisher's theoretical work (20). Fisher develops a framework to reduce the negative effects on the commercial market by distributing the commodity aid at a price lower than that in the commercial market. In other words, Fisher employes a differentiated market.

Rogers expanded upon the Mann analysis by dividing the demand into two equations (56, p. 122). He makes the division because in India the aid is distributed through a differentiated market system known as the fair price shops. He has one equation for the open-market demand and one for the concessional market. Rogers concludes that the impact of aid on domestic supply is less than 9 percent of the magnitude estimated by Mann (56, p. 136). The "distribution through fair price shops in India has provided for increased consumption amounting to 93 percent of the amount imported" (56, p. 137).

Thus, while Mann concludes the effect of aid on the commercial market is large Rogers concludes it is not. Other less empirical arguments have supported both sides of this debate. These arguments hinge on the supply response of the commercial producers. Those who argue that the recipient's production is not price responsive claim aid has little negative effect because domestic output does not decline. In contrast, those who argue that production is price responsive conclude aid causes negative effects. Mellor concludes that empirical studies have generally shown production to be price responsive (44, p. 202).

Essentially all of these studies have been oriented around partial analysis. Some of the studies have introduced more than one sector and analyzed macroeconomic elements of food aid. But none of the food aid studies have used a more general model of an entire economy as a starting point in their analysis. The study by Fisher typifies the extent to which the analysis has been oriented toward a single sector of the economy. He states his purpose as:

> This paper presents a theoretical analysis of the problems raised for the domestic agriculture of underdeveloped countries by the use of foreign food surpluses. The issues analyzed are twofold: (1) How large and serious a discouragement to domestic agriculture is the importation of foreign food surpluses? (2) Given the type of expenditures for economic development to which the receipts from surplus sales are devoted, by how much do such expenditures offset any negative effect of the surplus by (directly or indirectly) encouraging development of domestic agriculture? In particular, how does the expenditure in such programs required to just offset such effects compare with the receipts from the sale of the surplus? (20, p. 863)

Fisher then presents an excellent analysis of the intricate relationship between the demand and supply of food to accomplish his objective. The characteristic of his paper which needs emphasis is its complete concern for the food sector. He includes an analysis of the indirect effects on demand for food resulting from the expenditure of the counterpart funds on general development programs (20, p. 870). He ends his paper with a plea for more empirical studies because no data are available to conduct the econometric analysis he presents (20, p. 874).

Although the theoretical analysis was not provided by Fisher until 1963, proposals to use a differentiated market were, although for other reasons, suggested nearly a decade earlier (45, p. 55). The proposals resulted from studies of utilization of food aid for economic development. Among the proposals were provision of food at no or little cost to the hungry or malnourished and distribution of food to the unemployed in return for their labor.

The criticism that aid is not as valuable as an equivalent nominal quantity of dollar aid has been stated many times by many authors. One of the most persuasive arguments on this point was made by Schultz (58).

He concluded that the value of food aid was only 37 percent of its cost to the Commodity Credit Corporation (58, p. 1023). Losses which occur from misvaluation arise from the selection of the quantity of aid given. Because of overvaluation the recipients may accept more aid than is economically rational. Likewise donors may offer more aid, believing it to have greater worth than its real value. The quantities of aid offered and accepted are dependent upon economic and non-economic judgments. The non-economic judgments are based on national security, altruism, need, politics, and other fears or preferences. Although the quantity of aid is important and interesting it is not pursued further because the concern of this study is the negative effects resulting from a given quantity of aid.

The monetary effects resulting from aid have been discussed in two seemingly isolated areas of the economic thought, commodity aid literature and international trade and finance literature. The commodity aid studies have concentrated upon the monetary impacts of counterpart funds, in particular those arising from P.L. 480 aid. The U. S. maintains ownership of the local currencies and has built up substantial quantities of them in countries that have received large amounts of aid under Title I of the act. These studies conclude that the timing of the transactions is important in terms of temporary inflationary and deflationary effects, but that otherwise commodity aid is neutral, except for income redistribution effects (38, pp. 10-14; 61, p. 11; 19, p. 8; 54, p. 16).

The international trade studies have been in the framework of international transfers which are usually considered to be capital. But

capital in real terms is commodities of one kind or another. The conclusion reached by these studies is summarized by Vanek:

> The problem really may be reduced to the question of what happens to the terms of trade if a transfer of real purchasing power is effected from one country to the other.... The extent of controversy on this particular question that has appeared in the past hundred years or so only emphasizes the point that there is no unique answer to the problem. The terms of trade may deteriorate or improve as a result of transfer (67, p. 241).

A change in the terms of trade relates to monetary effects. Thus, the conclusion of this body of knowledge is that the monetary effects of commodity aid are a priori indeterminate.

As you see, there is a conflict. The commodity aid literature has reached the conclusion that aid is neutral if the timing and income distribution problems are ignored. The international trade and finance literature conclude that the impact of aid is an empirical question.

Goals of This Study

There have been both theoretical arguments and empirical demonstrations of the negative impacts of commodity aid. The first objective of this study is to broaden, deepen, and clarify the theoretical arguments and to add to the empirical evidence on the negative impacts. The second objective is to develop and investigate policies which would eliminate the negative effects of aid on the commercial markets.

The previous section indicates that both the problems of commodity aid displacing commercial sales and the direction of the monetary effects have been analyzed. However, the results are conflicting and the analyses have centered on single-sector models. An attempt is made to resolve the conflicts and expand the study of aid with the use of multisectoral analysis.

The study of the impact of aid on the commercial market has concentrated upon the one market for the commodity received as aid. But what about the other markets? While even the indirect effects on the one market have been considered, not even the direct, let alone indirect, effects on the other markets have been discussed. By turning away from single-sector models to a multisector model, the effects of aid on all the sectors of the recipient's economy will be investigated. If all negative effects are to be minimized or eliminated, all sectors must be included. Very little is known about the proportion of the total impact of aid on all sectors which is accounted for by the one sector which produces commodities similar to the aid imports.

The analysis of foreign aid in general has included all sectors. The utilization of foreign aid, including commodity aid, has recognized that the entire economy must be considered (45, pp. 59-60). That need is recognized because of the desire to put the aid to its best possible use, i.e., attain the greatest benefits from it. Why has an economy-wide approach been used to measure the benefits and a single-sector approach been employed to measure the losses?

Reasons for this discrepancy are probably many; it is useful to contemplate a couple. First, the historical setting of commodity aid may have added a bias to ignore its negative effects. Most commodity aid has been in the form of U. S. agricultural surpluses. (50, p. 76). The desire to dispose of the surpluses motivated the aid as much as the need for it (30, pp. 1-3). Thus, the donor's self-interest may justify aid without full consideration of its effects. Food aid was offered before it was fully evaluated. In contrast, the studies oriented toward

general economic aid have usually evaluated the aid prior to offering it. The evaluation included the amount of aid needed from the standpoint of the recipient. Second, food aid has received special emphasis and hence may not have been subjected to the more complete analyses applied to general aid. This special position of food aid is illustrated by the annual review of the largest group of aid donors, viz., the Development Assistance Committee. Their 1971 review lists the "categories of official development assistance" as "multilateral contributions, food aid, technical assistance, supporting and budget assistance, and project and programme lending" (50, pp. 51-53). In it an entire chapter is devoted to food aid. A similar slant on aid is presented by the Report of the Commission of International Development (53). Of all aid in commodity form, the only one generally singled out is food aid.

Some of the conflict over the impacts of aid have arisen because of variations in the comprehensiveness of different studies. This is illustrated by the differences between the studies by Mann and Rogers. Generally a more complete study is preferred. An analogous preference holds with regard to the policies governing commodity aid. The more intensive microeconomic studies at the small policy level are very essential, but a more general overall view of the policy is also necessary to get the complete picture (63, p. 75). A multisectoral approach is used in this study to derive policies which account for all the negative effects transmitted through the commercial market.

CHAPTER II. MULTISECTORAL ANALYSIS

Alternative Models

The purpose of employing multisector models is to permit interactions between sectors of the economy. A most detailed model of an economy which allows for all economic interactions is known as a general equilibrium model. Such models take account of each individual consumer and each production unit. The consumer demands and producer supplies are aggregated into a market demand and supply respectively for each commodity. The concept and theoretical construct of general equilibrium have been known by economists since Walras. However, the application of a general equilibrium system still remains in the frontiers of economic thought.

An econometric model of all markets provides the second most detail of an economy. For each class of commodities there is a sector with a supply and demand equation. If used to study the impacts of aid, it would reflect both price and quantity changes. However, the construction of such a model is monumental even for the most highly developed economies with voluminous data sources. As reviewed above, Fisher admits the lack of adequate data for an econometric study with only a single sector. Consequently, another multisector model must be found in order to readily apply it to the problems of aid.

The model which can most readily be employed is input-output analysis. The technique of input-output analysis was really the first application of a multisectoral system. It is too restrictive to be a general equilibrium model. Among its biggest restrictions are an inflexible

price system; no choice of production methods; no monetary system; and the usual aggregation of commodity classes, firms, and individuals. Although a model with fewer and less restrictive assumptions is desirable, the current availability of data and general applicability make the use of input-output a satisfactory empirical approach. As the frontiers of theory and data computation and collection are pushed back, more complex and less restrictive general models may replace the basic input-output model.

The input-output method can be used for many purposes. Because of this, its simplicity, and its similarity with national accounting, it is often the first multisector model constructed for a country. An input-output bibliography compiled by the United Nations has entries for 50 countries under "National Studies" (65). Those countries received 86 percent, $15, 661.4 millions, of all P.L. 480 aid between 1954-55 and 1968-69 inclusive (27). Although these studies have limitations, they are a large wealth of data.

The methods of this study must be applicable to the recipient countries of commodity aid. They are generally less developed and have less data available for use in analysis and planning and at the same time can ill afford using skilled labor to compile it. Thus, the data to be used must be available or require a small cost of acquisition. It will be shown that available input-output tables can contribute information for the analysis of aid. The advantage and convenience of such an approach should be obvious.

There are two alternative approaches to simultaneous price and quantity changes. First, fix prices and investigate the change in

quantities. Second, fix quantities and investigate the change in prices. The first alternative is the one which will be employed with the input-output analysis. From the perspective of economic growth and development, the change in real output with constant prices provides a measure, even though second best, of the effect of commodity aid.

This study will use the input-output model as a basis to analyze and plan commodity aid. The reduction in output of the several sectors given imports and a fixed final demand will be derived. The required changes in final demand given fixed production and imports will also be derived. In addition, the model will be used to show the change in the impacts of aid on the several sectors resulting from a structural change.

A Brief Description of Input-output

The fundamentals of input-output have been detailed in several readily available sources (11, 40, 46, 62, 66). Hence, they will not be reviewed here. To facilitate the understanding of the analyses which follow, a brief summary of the method, terminology, and notation is provided.

Input-output is a technique used to show the flow of goods between sectors of the economy with a given time period. A year is the common period used for data collection and it meets requirements of the method. The number of sectors is not fixed by the technique but depends upon the problem being analyzed and the data available. Services and non-produced primary factors can be introduced into the technique; however, the main emphasis is upon the interdependence of the producing sectors.

To simplify presentation, matrix notation will be used. The subscript "i" indicates row i of a matrix or element i of a vector. The subscript "j" indicates column j of a matrix. The first subscript indicates the row, the second the column. Vectors are column vectors unless they are transposed which is indicated by an apostrophe. A diagonal matrix formed from the elements of a vector is indicated by underscoring the vector. The inverse of a matrix is indicated by the superscript "-1." Basic symbols are:

- q output vector where q_i is the output of industry i,
- Q transactions matrix where Q_{ij} is the flow of domestically produced output of industry i to industry j,
- Y final demand matrix where Y_{ij} is demand for the output of industry i by final demand sector j,
- y final demand vector where y_i is final demand for output of industry i,
- A input coefficients matrix where A_{ij} is the flow of output of industry i to industry j per unit output of industry j,
- V value added matrix where V_{ij} is value added by primary resource i to the output of industry j,
- Z resource consumption matrix where Z_{ij} is the flow of primary resource i into final demand sector j,
- I identity matrix,
- i_1 unit vector conformable with Q, and
- i_2 unit vector conformable with Y.

Note that A_{ij} equals $\frac{Q_{ij}}{q_j}$, and that Yi_2 equals Y.

The input-output model assumes the two relationships of equations 2.1 and 2.2. Equation 2.1 states that output equals the sum of

(2.1) $q = Qi_1 + Yi_2$

intermediate demand, Qi_1, and final demand, Yi_2. Equation 2.2 states

(2.2) $A = \underline{Q}q^{-1}$

that the coefficients of production are fixed, i.e., the inputs of sector i into sector j per unit output of sector j are assumed to be equal to the ratio of the total inputs from sector i into sector j to the total output of sector j.

Postmultiplying equation 2.2 by q gives

$Aq = \underline{Q}q^{-1}q$ or

(2.3) $Aq = Qi_1$.

Substituting Aq for Qi_1 in equation 2.1 gives

$q = Aq + Yi_2$ or

(2.4) $y = (I - A)q$.

Rearranging equation 2.4 gives

(2.5) $q = (I - A)^{-1}y$.

Equation 2.4 has the economic interpretation that given the (I - A) matrix and the output vector, the final demand vector can be calculated. Similarly, equation 2.5 permits calculation of the total output vector given the $(I - A)^{-1}$ matrix and the final demand vector.

The total demand of each sector is equal to the total supply of each sector because of the accounting derivation of the data for the

input-output model. In practice the data collected may not yield a balance and often a balance is then introduced by a general nebulous sector entitled "other." This is the characteristic of the input-output model which permits it to be described as an equilibrium model.

The value of output of each industry is generally greater than the value of the produced goods which were used as inputs into the industry. The difference between an industry's value of output and its value of produced inputs is called its value added. This is the return to the non-produced factors it uses of which labor, profit, and indirect taxes are common examples.

The input-output model can be characterized as a four-quadrant table, Table II-1. Each column of quadrants II and III can be considered

Table II-1. A simple input-output framework

Q	Y
V	Z

the productive activity of an industry where elements of Q show required inputs of produced goods and elements of V show required inputs of primary goods and value added. The input for industry j from industry i may also be viewed as the output of industry i demanded by industry j. Then quadrants I and II represent the distribution of the output of an industry where elements of Q are the flows to the other industries and the elements of Y are the flows into the several final demand sectors. The sum of all these flows is the total output of the industry.

The elements of a column in Table II-1 cannot be added if the variables are expressed in physical quantities because they are heterogeneous. However, if the variables are expressed in units of a common value, e.g., dollars, an interpretation can be given to the column sums. Recall that the columns may be considered productive activities. The costs of the produced inputs of an industry are given by the elements of a column of Q. The costs of non-produced inputs and value added including any residual costs such as taxes and profits are represented by the elements of V. The total cost of an industry is the cost of all inputs, including taxes, etc., and is represented by a column sum less profits. By definition profits equal total revenue less total costs. Total revenue is the value of all output, which for an industry is the sum of a row of Table II-1. Since total revenue equals total costs plus profits, the sum of a row equals the sum of the corresponding column.

The column sums of quadrants I and IV and the row sums of quadrants III and IV require a different interpretation. The total of the row sums is the national income at factor cost. The total of the column sums is the national income at market prices.[1]

The model has been described by the four matrices Q, Y, V, and Z. In practice this is the form in which empirical data is presented. The matrix Q may vary in size depending on the problems to be studied, data available, and structure of the economy, but it is always square. An example of the rows which might appear in V are gross inventory

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[1]For a deeper explanation of the relationship of input-output to the national accounts see Stone (62).

depletion, imports, payments to government, depreciation allowances, and households (46, p. 9). Matrix Z has as many rows as V and as many columns as Y. Final demand is usually presented as a matrix, Y, rather than a vector, y, because it contains more information. However, for mathematical presentation of the model, Y is usually aggregated to derive y so that equations 2.4 and 2.5 are applicable.

A sector can be included either in Q or Y. The determination of which sectors are in each is dependent upon the problem being studied. In fact the system may be closed in which case no sectors are included in Y. Those usually included in Y have inputs (column elements) which are not dependent upon their total output. For example, the individual elements of the household final demand sector are usually not considered to be dependent upon the total output (labor supplied) of the households.

The calculation with the input-output model of the effects of aid will always be determined with a fixed technology. The $(I - A)^{-1}$ does not change unless there is a structural change. This exception is discussed in Chapter VI. However, the difference in the effects of aid for two different technologies can and will be compared.

International Trade in the Input-output Model

The model presented above must be expanded to encompass international transactions. This can be accomplished by considering the two types of international transactions, exports and imports. For this study imports are the most important since commodity aid is a special type of them. However, before incorporating imports into the model, exports are briefly considered.

Exports are crucial to all countries because over the long term they provide the wherewithal to purchase imports. Imports may be financed by other methods such as depleting the stock of international exchange or gold reserves, international borrowing, or selling claims on particular assets. However, these methods of financing imports are generally considered to be inferior to selling exports because they either reduce the international liquidity of the country or increase the foreign ownership of domestic assets.

The developing countries have an urgent need for adequate export earnings to obtain imports. This need is the acquisition of capital goods necessary to undertake an adequate investment program for development. The pressing need for foreign exchange in many less developed countries has resulted in the construction of import substitution and two-gap models. Countries have always desired to minimize imports, but the stress on import substitution arose in the early 1950's with the stress on insufficient capital for development (36, p. 4). Chenery and Bruno developed a two-gap model which stresses both inadequate savings and foreign exchange shortages (10).

The export sector is as a rule placed into the final demand matrix, Y, of Table II-1. This is because the level of exports originating in the several sectors is dependent upon foreign demand and the international market. The export sector should be in Q only if the level of exports originating in each of the several sectors depends upon the total level of all exports.

The integration of imports into the model is more complicated. The increased difficulty with imports arises because they may either be

employed as inputs into production or consumed in final demand. Caution must be exercised when imports are included so that the appropriate A matrix is derived.

A two-way classification scheme is introduced to facilitate incorporating imports into the input-output framework. It may readily be applied to both commercial and aid imports. The classes of the first classification are competing and non-competing imports. Competing imports are those goods which are both produced domestically and imported. Non-competing imports are goods which are only imported. The second classification is based upon the sector which uses the imports. One class is imports used in the intermediate demand sectors. The complementary class is imports consumed in the final demand sectors. These two sets of classes are easily visualized with the aid of Table II-2.

Table II-2. Classification of imports

		Competition	
		Competing	Non-competing
Destination	Intermediate demand	class I	class II
	Final demand	class III	class IV

Now that different types of imports have been distinguished, methods of entering them into the input-output model are considered.

Class I imports require a change in Q because they enter intermediate demand. To maintain consistency of the model this change forces a change in either q or y. Unless this change is made in y, an inappropriate A matrix results.

Recall that intermediate and final demand (required intermediate and final supply) equals total demand (supply) by equation 2.1. Assume there are two sectors and one final demand vector. Equation 2.1 can then be written as equations 2.6 and 2.7. So far all variables have referred to a domestic economy.

$$(2.6) \qquad Q_{11} + Q_{12} + y_1 = q_1$$

$$(2.7) \qquad Q_{21} + Q_{22} + y_2 = q_2$$

Now assume class I imports which are competitive with commodity 1 and used in sector 2 enter the economy. The total flow of commodity 1 to sector 2, Q_{12}, is partly from domestic production and partly from imports. Let the domestically produced quantity and imported quantity be Q_{12}^d and Q_{12}^m respectively. Then Q_{12} in equation 2.6 could be replaced by the sum $Q_{12}^d + Q_{12}^m$. But without further adjustments this substitution is unacceptable because it implies the sum $Q_{11} + Q_{12}^d + Q_{12}^m + y_1$ equals the domestic production of commodity 1. This is a contradiction since Q_{12}^m is not domestically produced. There are two alternatives to correct the contradiction. The quantity of imports, Q_{12}^m, can be subtracted from y_1 or it can be added to q_1. However, when A, the input coefficients matrix, is based on the latter procedure, undesirable results occur. Those results are shown in equation 2.8. The first column of A is no

$$(2.8) \qquad A = \begin{bmatrix} \dfrac{Q_{11}}{q_1 + Q_{12}^m} & \dfrac{Q_{12}^d + Q_{12}^m}{q_2} \\ \dfrac{Q_{21}}{q_1 + Q_{12}^m} & \dfrac{Q_{22}}{q_2} \end{bmatrix}$$

longer the input commodities of the respective rows per unit output (production), but is the input per unit of the sum of output and imports. This gives the production coefficients of the first column a downward bias because it decreased them without a concurrent structural change. These coefficients may also be unstable because they are made dependent upon the imports of the commodity produced by sector 1 and used in sector 2 (66, p. 52). The input coefficients of sector 2 (column 2 of A) do provide what is desired, namely, the input of commodities of the several sectors, regardless of the source of the inputs, per unit output of the second sector. Since the second alternative is unsatisfactory, the first alternative of subtracting Q_{12}^m from y_1 is considered. This procedure yields an acceptable A matrix, equation 2.9, where the right-hand side of equation 2.6 is unaffected and Q_{12}^m is eliminated from the divisor used to calculate the input coefficients

$$(2.9) \qquad A = \begin{bmatrix} \dfrac{Q_{11}}{q_1} & \dfrac{Q_{12}^d + Q_{12}^m}{q_2} \\ \dfrac{Q_{21}}{q_1} & \dfrac{Q_{22}}{q_2} \end{bmatrix}$$

of sector 1. If the Q_{12}^m imports are added to Q_{12}^d and subtracted from y_1, the appropriate A matrix is obtained.

The imports of class II are less difficult to include in the input-output system. There is no domestic production of such imports so the problem of substitution between domestically produced and imported goods does not arise. Class II imports are similar to primary inputs in that they can be introduced into the model through quadrants III and IV of Table II-1. Each element in this row shows the non-competing imports required for the production of the column's output. The class II imports so allocated do not affect the A matrix and therefore introduce fewer complications than class I imports.

In contrast to other rows in the model, the elements of the row of class II imports are not likely to consist of physically homogeneous goods. The required non-competing imports for one sector may not be the same as those required by another sector. In fact, even the goods represented by a single element may be heterogeneous because two or more very dissimilar goods may be required as non-competing imports into a sector.

When there are class III imports, consumption in final demand is partially satisfied by imported goods. To introduce them into the model equations 2.6 and 2.7 are used again. Let Y_{1m} be the quantity of class III imports of commodity 1 consumed by final demand. Let Y_{11} be the domestically produced quantity of commodity 1 consumed by final demand. The same problem arises as for class I imports. If the sum $Y_{11} + Y_{1m}$ is substituted for y_1 in equation 2.6, the expression implies the unacceptable result that domestic output of commodity 1

consists partly of imports. To correct the implication, Y_{1m} must either be subtracted from final demand or added to q_1 in equation 2.6.

Again caution is required so that the A matrix is not changed when in fact there have been no structural changes. Consequently, subtracting the imports from final demand is the only acceptable alternative. This leads to the ironical situation that class III imports appear twice in the final demand sector, first as a positive quantity when the sum $Y_{11} + Y_{1m}$ replaces y_1, and second as a negative quantity in the import sector of final demand. When data for an input-output model are presented in a form similar to Table II-1, class III imports, and possibly other imports, are listed in a column of Y. When the A matrix is calculated, they must not be included in q, the row sums of Table II-1.

The interest in class IV imports is very small for the purpose of this study, but their analysis is included for the sake of completeness. Class IV imports are non-competing and destined for final demand. Because they are non-competitive, they may be placed in the row where the class II imports were placed; but since they are destined for final demand they are placed in Z rather than V in Table II-1. Class IV imports are placed into the several columns of Z on the basis of their destination. For example, suppose three sectors comprise final demand; let them be households, government, and investment. Also, suppose there is a row for non-competing imports and that there are Z_{mj} class IV imports which are used in the household final demand. Then at the intersection of the non-competing import row and the household column,

the quantity Z_{mj} would be entered. If there is no row of non-competing imports, one can simply be invented to accommodate the class IV imports. Like the entries of class II, the class IV imports are not likely to be a homogeneous set of goods.

CHAPTER III. COMMERCIAL VS. AID IMPORTS

Distinction Between Commercial and Aid Imports

In this chapter those forms of foreign aid which can be subjected to the analysis of this study are determined. The problems under investigation largely result from aid which originates in commodity form but the methods of the study have a wider application. In Chapter II imports were divided into four classes for the purpose of entering them into the input-output model. It is now useful to distinguish between commercial imports and aid imports which result from foreign aid. Not all foreign aid is commodity aid. In the next section it is argued that regardless of the original form of aid its most likely ultimate use is purchases of commodities for import. The input-output framework can be used to analyze the effects of these imports.

Foreign aid has been defined in many ways and the definition is often influenced by the problem at hand. There are several characteristics important to the definition of aid and some are impossible to accurately and objectively identify. For this reason one encounters statements like "one is forced to say that 'aid' is what people say is 'aid'" (31, p. 25). The particular characteristic of foreign aid which Hawkins has in mind is the motivation of the donor. Foreign aid has been defined by default, i.e., as the flow of resources which did not occur as a result of free market forces. Mikesell's definition is an example of this approach, "...a transfer of real resources or intermediate claims on resources from one country to another which would not have taken place

as a consequence of the operation of market forces or in the absence of specific official action designed to promote the transfer by the donocountry" (47, p. 194). Other authors have stressed other aspects of aid.[1] The purpose here is not to provide the final word on the definition of aid but to discuss the various characteristics of aid and their incorporation into the analytical techniques that are developed.

Three of the more important qualities of aid are its form, the characteristics of its donor, and the perspective of its evaluators. The form of aid refers to the qualities of the resources which flow as aid and the qualifications or restrictions which are attached to them. Examples of forms are convertible currencies, inconvertible currencies, aid in kind, technical assistance, etc. Examples of qualifications are grants (no qualifications), tied aid, loans of various degrees of softness, etc. Associated with the form of aid is the question of the measurement of aid. That is, does the amount of aid include the total transaction associated with aid or only the pure grant element of the transactions?

The two major types of characteristics of the donor are his public (official) vs. private nature and his motivations. The distinction between public and private donors is not always clear because public sanctions often influence private aid. An example of this mixed donor characteristic is P.L. 480 Title II aid provided by donations through voluntary relief agencies.

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[1] For further considerations of the definition of foreign aid see references 49, chapters I and IV-VI; 53, pp. 3 and 147; 32, pp. 14-15; 42, pp. 13-14; and 3, p. 1.

The motivations of the donor encompass a wide range of possibilities. Three of the most commonly announced motivations include the humanitarian desire to help the poor and needy, the benefit of freedom through military security, and the desire to aid less developed economies in the process of development. When analyzed in fine detail there are probably as many if not more motives for giving aid than there are donors. Some of the motives of the donors are based upon self-interest such as giving aid in the hope of expanding commercial exports.

The third major consideration of aid, which is a frequent source of disagreement over its value, is whether it is viewed from the donor's or recipient's standpoint. This is a legitimate basis for disagreement and can arise even though the influence of value judgments is minimized in the analysis. The donor is prone to evaluate the aid it provides by calculating the economic cost incurred when procuring the aid. In contrast, the recipient is prone to evaluate the aid by calculating the net benefits from receiving the aid. Except for happenstance or very accurate and precise planning (the condition of the supply of the commodity aid equaling the demand for the aid in the context of a free market for aid), there is no reason why the two evaluations of commodity aid would be equal. A pure unqualified grant of a convertible currency, gold, or other highly mobile resource with a well established international market may not cause such discrepancy.

Having discussed the characteristics of different types of foreign aid, the problems of deriving an all encompassing definition of foreign aid including its valuation are obvious. Hence, separating commercial and aid imports is a difficult task. When foreign aid results in imports

of commodities, they can be incorporated into the input-output model as in Chapter II. Thus, the methods can be used to analyze the part of foreign aid which ultimately takes the form of commodity imports. The ultimate form or use of aid is the topic of the next section. Fortunately, the use of the analysis does not depend upon the definition of foreign aid. It applies to whatever someone has defined as aid.

Form and Potential Uses of Foreign Aid

There are three basic forms of aid, goods, currency, and technical assistance. Each of these forms may be made with various conditions of financing and tying, but aid (recall it may be considered a flow of resources) must be either in the form of consumption or investment goods (goods), money (currency), or labor services (technical assistance). The input-output model employed in this study analyzes aid in the form of goods. However, it is shown below that monetary aid is often converted into imports of goods. The expansion of the model to include technical assistance is discussed and is not conceptually difficult.

The different uses of aid are considered to relate the form of aid to the application of the model. They are imports, budgetary support, debt service, reserves, re-export, aid, and lend. This list is exhaustive but not mutually exclusive. It is considered in reverse order.

It is unlikely that an aid recipient country will wish to use aid for purposes of giving aid and lending as most are too poor. Even if they desired to give the aid away it is not likely that the donor would provide it under those circumstances. Neither is it likely that the donor would

agree to give aid for re-export. That would compete with the donor's commercial exports as well as affect the market for other exporters.

For the remainder of this section aid is defined as pure grants or the pure grant element of any transactions which are neither pure grants nor entirely commercial. This definition prevents the coincidental rise in debts and the receipt of aid in loan form. Such a coincidence is real and it does happen as evidenced by the existing large debt service problems of many less developed countries. However, it obscures the significance of aid because aid is more than the negotiation and servicing of a loan. This definition is unique to this section. Elsewhere aid implies nominal aid not just the grant element.

No country, especially one receiving aid, will service debts unless it has a commitment to do so. Likewise, no country is likely to increase reserves just to accumulate hoards. Because aid raises the recipient's level of income, the recipient may choose to improve his liquidity by using part of the aid to service debts or increase reserves. However, recipients of aid are not likely to disperse an entire increase in income for improvements in liquidity because they are poor and need income for consumption and investment. Other than a small shift in liquidity preference resulting from the income increase, the reception of aid does not increase the recipient's need for debt service or reserves. Thus, if a recipient country uses substantial portions of aid for debt service or reserves, there must have been a pre-existing requirement to decrease debts or increase reserves. If aid were not available, some other means of satisfying the requirements would be undertaken. Foreign debts can be serviced by increased exports or reduced imports. The same

two alternatives apply to increasing foreign reserves. It is not easy for a country to control its exports, at least to expand them, and therefore the usual policy measure to service debts or accumulate reserves is to reduce imports. Consequently, if aid is used to service debts or accumulate reserves it substitutes for import reduction and is in effect a means of import expansion.

Budgetary support is the use of aid to improve the recipient government's budget. If the budetary aid is in the form of goods the use is the same as imports. Those goods may be used directly in the government sector or in any other sectors if the government chooses to give them away or sell them. If the budgetary aid is in the form of foreign currency, the government may either import goods, service debt, expand reserves, or exchange it for local currency. If it is exchanged for local currency, those who get the foreign aid currency in exchange will presumably not hoard it but use it in the foreign market. By using it in the foreign market they will either purchase goods or buy foreign assets or accounts. Both the donor and the recipient governments are likely to try to prevent the purchase of foreign assets or accounts. Hence, the substantial part of aid which is used for budgetary aid will ultimately be used to purchase imports.

The last remaining allocation of aid is its use for imports. This use is simply the allocation of aid to buy foreign goods. If the aid is already supplied as goods, no further transactions are required. If aid is supplied as foreign currency then the recipient simply uses the foreign currency to purchase imports.

Aid received in commodity form needs special attention. The recipient government may sell the commodities for local currencies. If it does, the use of the aid is determined by the government's expenditure of the proceeds. These then can be used for budgetary support and their expenditure may effect the level of imports. However, the major change in imports is the original receipt of the commodity aid. In the case of P.L. 480 the U. S. maintains ownership of the local currency sale proceeds. Guidelines for the use of these local currencies are specified by the law (30, pp. 45-46). These uses tend to depress the exports of the recipient or reduce its supply of foreign currencies. An example of this is the payment of U. S. obligations with the sale proceeds.

So far, aid in the form of technical assistance has not been considered. Technical assistance is specialized labor services and as such may be put into the input-output model of Chapter II as a row in the primary input matrix. The technical assistance would be in the V matrix of Table II-1 if used in the producing sectors or in the Z matrix of Table II-1 if used in the final demand sectors. It is not likely that the donor of technical assistance will let it be sold and converted into another form. However, the recipient government could sell the technical assistance to domestic firms and use the proceeds for budgetary assistance. But, this merely adds a transaction to the process and doesn't effect the form of aid; at most it effects the choice of sectors where the aid is used.

Summarizing, it has been argued that regardless of the form of aid--goods, currency, or technical assistance--much of the aid will

ultimately be used to import more goods. This does not mean that the trend of imports will necessarily be rising, but rather that imports will be greater with aid than they would have been without it.

CHAPTER IV. THE ANALYSIS OF COMMODITY AID WITH INPUT-OUTPUT

P.L. 480 Aid as a Special Case

It was argued above that the methods of this study may also be useful for the analysis of other forms of aid which result in increased imports. Now instead of broadening the application, a few comments must be made on limiting the methods to account for the specifics of P.L. 480 aid. Since there already exist several discussions of the history and nature of P.L. 480, the only descriptions of it given here will be those necessary to apply the model.[1]

The letter-of-the-law of P.L. 480 as amended stipulates the level of commercial trade of the same commodities received as aid should not be diminished (64, p. 41). Therefore, there is legally little reason to consider a decrease in commercial imports as an alternative to increasing final demand. However, the point of reference for measuring the substitution of aid for commercial imports is the historical level of imports. This standard does not prohibit the aid imports from substituting for the expansion of commercial trade.

The law also stipulates that the recipient government have a policy and be determined to improve its domestic agriculture (64, pp. 41, 43). However, no stipulations for the development of particular agricultural commodities are made, except for food crops vs. non-food crops which are in surplus. Consequently the substitution of aid for domestic

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[1] For a fuller description of P.L. 480 see references 56, Chapter II; 30; and 64.

production could be justified if domestic resources are shifted to the production of other agricultural commodities which result in development. Besides, in practice substitution for domestic production, like substitution for commercial imports, is difficult to prevent. Hence, there are two reasons for not making the distinction between P.L. 480 imports and commodity aid in general. First, P.L. 480 as amended is general and some interpretations of it would permit aid to substitute for commercial market transactions. Second, even if the law is interpreted to prohibit such substitutions, in reality they are almost impossible, at least under current policies, to prevent. Therefore, the study will include the analysis of the substitution of aid for domestic production and commercial imports.

Class III Aid Imports

The most common commodity aid imports, class III, are considered first. Such aid is received in the form of a commodity which is competitive with the recipient's domestic production and consumed in the final demand sector. Now, suppose the problem which arises is the effects of a given amount of aid imports of commodity 1 on the economy.[1] The introduction of aid imports into the model is the same as commercial imports, because, even though their financing is different, both are real resources added to the economy.

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[1]Throughout this chapter a specific commodity is selected to facilitate exposition, but the analysis is general because any commodity could have been chosen.

An equation for sector 1 can be taken from the matrix equation 2.1. For convenience assume there are only two sectors. Then the equation for sector 1 is equation 4.1.

$$(4.1) \qquad Q_{11} + Q_{12} + Y_1 = q_1$$

Now commercial imports of commodity 1 utilized by final demand can be introduced. Let Y_{11} be the final demand for the domestic production of commodity 1, Y_{1m} the commercial imports of commodity 1 utilized by final demand, and consider equation 4.2.

$$(4.2) \qquad Q_{11} + Q_{12} + Y_{11} + Y_{1m} = q_1$$

If aid in the form of class III imports enters this system, two basic outcomes or a combination of them could occur. Let the level of class III aid imports of commodity 1 be Y_{1m}^{3a}. Either final demand for commodity 1 in the aggregate must rise by Y_{1m}^{3a} or the aid will substitute for the final demand satisfied by the commercial market, $Y_{11} + Y_{1m}$. The input-output equation illustrates that one of these two basic outcomes must occur or there would be an imbalance in the supply and demand of the commodity. If Y_{1m}^{3a} displaces part or all of Y_{11}, aid substitutes for domestic production. If it displaces part or all of Y_{1m}, it substitutes for commercial imports.

Probably when and where commodity aid is given, there will be commercial imports of the commodity, but most likely there will be no exports of the commodity. If, however, the rare case of exporting the commodity did exist, Y_{1m} could be interpreted as net imports.

Final demand must expand by Y_{1m}^{3a}, if the increased supply resulting from the same quantity of aid is to be offset. That is, the final demand must be expanded to accommodate both the previous level of domestic production and commercial imports as well as the new additional aid. The means of doing this is complex and will be considered in the next chapter.

If class III aid imports are permitted to substitute for commercial imports there are no direct effects upon the input-output system, i.e., the values of y, q, and Q remain the same. In this case one type of class III imports has simply displaced another type of class III imports. There are, however, indirect effects to consider. The best approach to these indirect effects is by a budgetary and balance of payments route. A shift from commercial to aid imports results in reduced foreign payments. Somewhere in the recipient economy the debt position or cash balances have improved. To be more specific, assume that it is the government which improves its position. As argued in Chapter III, it is unlikely that the government will simply reduce foreign debt or increase its cash reserves. Probably there will be a rise in government purchases or a reduction in taxes. In either case, final demand for domestic goods, y, is likely to rise. Which sectors will experience a greater demand will depend upon which consumers have rises in incomes and hence upon how the foreign aid is distributed. A fall in government costs (reduced debt services or foreign obligations) is likely to result in a greater demand for investment goods than a fall in private costs (reduced taxes). This is due to government emphasis in less developed countries on development and growth.

The well known procedure of input-output is to formulate the system given by equation 2.5. Using it when given the final demand, the total output can be calculated. When projections of changes in final demand are made, the model can be used to calculate the effects on sectoral output. Two approaches are available which yield the same solution when properly interpreted. The first approach is to employ the model to give the level of economic production of the several sectors directly in the solution. The effect of the commodity aid can be determined by comparing the solution with aid to the solution which results without aid. The second approach is to directly determine the impact of the aid on the sectoral outputs.

The first approach requires the analysis without aid using the standard input-output system given by equation 2.5. That gives q, the sectoral output levels without aid. Let the amount of final demand satisfied by domestic production when aid substitutes for commercial imports be y^{3a} where the superscript refers to class III imports. The new sectoral levels of output are given by q^{3a} in equation 4.3. The difference $q - q^{3a}$ is the effect of aid upon domestic production.

$$(4.3) \qquad q^{3a} = (I - A)^{-1} y^{3a}$$

With the second approach the effects of aid upon domestic production are calculated directly. Let y^{a} be the signed changes in the final demand to be satisfied by domestic production. Then the changes in production levels, q^{a}, are given by equation 4.4. The relationship between the two approaches is given by equations 4.5 and 4.6.

$$(4.4) \qquad q^a = (I - A)^{-1} y^a$$

$$(4.5) \qquad y^{3a} = y + y^a$$

$$(4.6) \qquad q^{3a} = q + q^a$$

As argued previously it is conceivable that a country could approach agricultural development by redirecting the emphasis on the product mix of the agricultural sector. This approach is the case of class III imports substituting for domestic production of the commodity imported. It means that the aid is consumed by the final demand sector and the domestic production of the commodity declines.

Again there are two approaches. The first approach solves for the levels of production of the sectors of the economy when aid is included. Let the solution prior to the aid again be given by equation 2.5. The level of sectoral outputs given class III aid imports substituting for domestic production is given by q^{3a} in equation 4.3 except that all elements of y^{3a} are changed. Let the quantity of aid be Y_{im}^{3a}. The elements of y^{3a} are now set identical to those of y in equation 2.5 except that the element y_i^{3a} equals the difference $y_i - Y_{im}^{3a}$. The effect of the aid follows from a comparison of the two solutions given by equations 4.5 and 4.6.

The second approach is given by equation 4.4 where y_i^a is set equal to $-Y_{im}^{3a}$ and all other elements of y^a are zero. The q^a vector then gives the effect on sectoral output of aid substituting for domestic production. The relation between the two approaches is the same as that in equations 4.5 and 4.6.

This method may seem somewhat baffling with regard to changing the fixed final demand vector to analyze the effects of class III aid imports substituting for domestic production. After all, the final demand of commodity i does not change! That is true, but the final demand satisfied by domestic production does change and it is domestic production which is of concern. If q_i, the total production of commodity i, were arbitrarily decreased by Y_{im}^{3a} (which at first blush seems more reasonable since the issue is the displacement of domestic production by aid and not a reduction in final demand) the implication would be a change in the final demand sector which would not likely equal Y_{im}^{3a}. That approach is analyzed below where the policy issue is the necessary change in final demand given fixed production targets.

It may be desirable to fix the level of production and solve for the final demand necessary to be consistent with the available supply. This problem arises if there is a minimum target for domestic production. This can easily be done by solving for y_i instead of q_i where sector i corresponds to the sector receiving commodity aid. Final demand must then be sufficient to absorb not just y_i but the total of y_i, commercial imports, and aid imports.

Given any system of equations, RT = S, where R is a square matrix and T and S are comformable vectors, the exogenous element i of T can become endogenous in place of element j of S so long as the element in row j and column i of R is non-zero. For the input-output system, R takes two forms, viz. (I - A) and $(I - A)^{-1}$. Note the difference in their economic interpretation. The condition for (I - A) has the meaning that an exogenous q_i can be made endogenous and the endogenous

y_j can be made exogenous so long as sector j uses inputs directly from sector i or i equals j. For $(I - A)^{-1}$ the condition has the meaning that exogenous y_j can be made endogenous and the endogenous q_i can be made exogenous so long as sector j uses inputs directly or indirectly from sector i or i equals j. These conditions will be called the mathematical condition of interchanging known and unknown variables. The condition is general and holds for any number of interchanges.

The mathematical procedure of reversing the role of two variables requires manipulation of the total input coefficients matrix, $(I - A)^{-1}$. Let the elements of this inverse matrix be designated by a_{ij}. Suppose the original system is equation 2.5 and that it is desired to make the m^{th} element of q, q_m, exogenous and the n^{th} element of y, y_n, endogenous. Then these two elements must interchange positions and the $(I - A)^{-1}$ matrix must be adjusted. Let the adjusted elements of $(I - A)^{-1}$ be denoted by a^*_{ij}. The rules for determining the a^*_{ij} elements are given by equations 4.7, 4.8, 4.9, and 4.10.

$$(4.7) \qquad a^*_{mn} = \frac{1}{a_{mn}}$$

$$(4.8) \qquad a^*_{mj} = -\frac{a_{mj}}{a_{mn}} \qquad \text{for all } j \neq n$$

$$(4.9) \qquad a^*_{in} = \frac{a_{in}}{a_{mn}} \qquad i \neq m$$

$$(4.10) \qquad a^*_{ij} = a_{ij} - \frac{a_{in}a_{mj}}{a_{mn}} \qquad i \neq m,\ j \neq n$$

This procedure is general and applies to any number of successive interchanges.

Solving for the final demand necessary to be consistent with a fixed level of production, q_i^{3a}, can again take two approaches. The first approach is to solve for y_i^{3a} and q^{3a} except for q_i^{3a} in equation 4.3. The exogenous variables are q_i^{3a} and y^{3a}, except for y_i^{3a}. Remember that interchanging variables requires that $(I - A)^{-1}$ be adjusted. The effect of the aid is shown by comparing these results with the original model given by equation 2.5. The new total final demand for sector i must equal the sum of y_i^{3a} given by the solution and the fixed quantities of commercial and aid imports.

The second approach is to solve directly for the effects of the aid consistent with the fixed level of domestic production, q_i^{3a}. The effects are calculated by using the net change in the production of sector i which is given by q_i^a where q_i^a equals the difference $q_i^{3a} - q_i$. Most cases of aid will require q_i^a to be negative because of a decrease in the level of domestic production. The computations use equation 4.4 where q_i^a and y^a except y_i^a, are fixed and y_i^a and q^a, except q_i^a, are endogenous. The two approaches are consistent and their relationship is given in equation 4.5 and 4.6. To retain consistency the identity of the knowns and unknowns must be the same for both. For other policy questions, it may be useful to interchange the exogenous-endogenous role of other elements of y and q. Also, it may be useful to fix the exogenous variables at levels other than those which exist without aid.

Class I Aid Imports

Recall that class I imports are classified as competing and enter the intermediate demand sectors. It is assumed that there are commercial class I imports. Let Q_{11}^m and Q_{12}^m be the quantities of class I commercial imports of commodity 1 which flow into sectors 1 and 2 respectively. Similarly let Q_{11}^d and Q_{12}^d be the quantities of commodity 1 domestically produced which flow into sectors 1 and 2 respectively. Then equation 2.1 becomes equation 4.11 where Q_1^m is the sum of Q_{11}^m and Q_{12}^m.

$$(4.11) \qquad (Q_{11}^d + Q_{11}^m) + (Q_{12}^d + Q_{12}^m) + y_1 = q_1 + Q_1^m$$

Now if class I aid imports of commodity 1 are introduced and no technological change occurs, three results (or a combination of them) are possible. Either the class I aid imports displace part of Q_{11}^d and/or Q_{12}^d, they displace part of Q_1^m, or intermediate demand for commodity 1 rises. The first and second displacements are the substitution of aid for domestic production and commercial imports respectively. If there is no increase in intermediate demand either q_1 or Q_1^m must fall.

Equation 2.5 implies that with a fixed technology the only way total output and hence total utilization in a state of equilibrium can increase is through an increase in final demand. Equation 2.1 shows that if total output and final demand are fixed, intermediate demand is also fixed. Thus, either final demand rises or there is a substitution of aid for domestic production or commercial imports.

A consideration of class I imports requires the analysis of the output of the sectors using the imports as inputs. Sectoral outputs are a function of total final demand. The exogenous total final demand consists of two types, the domestic final demand, y, and exports. However, a sector requires the same input increase for a given change in final demand regardless of the final demand type. Therefore, for simplicity, any increase in final demand will be found as an increase in one or more elements of the y vector. Keep in mind that some or all of such increases could in fact be supplying export rather than domestic markets.

Through the use of the input-output technique, the various combinations of y and q which would be sufficient to prevent a decline in domestic production or commercial imports may be explored. Again there are two approaches. To begin the first approach, equation 2.5 can be employed to find the solution to the economy without aid imports. When aid is incorporated into the economy, equation 4.12 can be used to find the solution.

$$(4.12) \qquad q^{la} = (I - A)^{-1} y^{la}$$

Suppose for policy purposes the level of domestic production, q_i, and commercial imports, Q_i^m, of commodity i are fixed at their current levels. Any levels deemed desirable for making the analysis could be made, but the current pre-aid levels are taken here to show the impact of aid. The value of y_i, final demand for the commodity domestically produced, is also fixed at its current level. If y_i were

permitted to increase instead of being fixed, the aid would in essence become class III imports. With Q_i^m, q_i, and y_i fixed, the solution must show both the level of final demand satisfied by domestic production and the level of domestic output of one of the other sectors, sector k. Momentarily the discussion will return to sector k.

Since the exogenous-endogenous role of the two variables must be changed, the definition of the vectors of equation 4.12 changes slightly. The two variables which are interchanged are y_k^{1a} and q_i^{1a}. Remember that interchanging two variables requires the appropriate adjustment of $(I - A)^{-1}$. So in equation 4.12 element i of vector q^{1a} is really the unknown y_k^{1a}; element k of vector y^{1a} is really the fixed value q_i^{1a}. Let the quantity of class I aid imports be Q_i^{1a}. Elements of y^{1a} are fixed at the same level as in vector y of equation 2.5 except that y_i^{1a} is set equal to the difference $y_1 - Q_i^{1a}$. Solving for the vector q^{1a} gives the required levels of output for all sectors other than sector i and the final demand required for sector k in order to prevent aid substitution for domestic production or commercial imports. The effects of the aid can again be derived from the difference between the two solutions of equations 2.5 and 4.12.

The second approach gives directly the required changes in y and q due to the aid. It uses equation 4.4. The roles of y_k^a and q_i^a are interchanged. Keep in mind that the interchanging of known and unknown variables requires manipulation of the $(I - A)^{-1}$ matrix. Elements i and k of y^a are set equal to $-Q_m^{1a}$ and c_i respectively; all its other elements are set equal to zero. Then the result, q^a, will give the changes in the levels of output of all sectors, except i, and

the change in final demand of sector k in order to prevent aid from substituting for the domestic production or commercial imports. This procedure may be done by either approach for more than one commodity at a time so long as the mathematical condition of interchanging known and unknown variables is satisfied.

Consideration must now be given to the selection of sector k. Potentially it could be any sector with a direct or indirect demand for commodity i. In reality the choice is quite likely to only concern a few sectors. These few sectors of prime concern can be viewed from the input-output table in terms of the structural analysis of the economy. Those sectors with a positive direct intermediate demand for the commodity received as aid are the relevant ones because they show where most of the intermediate demand lies.

Which of the potential sectors should be chosen to be sector k? If chosen each of the potential sectors would result in a different solution for the system because each of the sectors has an unique set of input requirements. Three criteria are suggested for making the choice. The first is the relative magnitude of the total (direct plus indirect) demand of the sector to be chosen for the aid imports (commodity i). The second criterion is the ability to attain the required final demand in that sector. Third, the development objectives of the aid recipient must be considered.

The first criterion can be analyzed through the observation of the basic input-output equations. These equations readily identify the consuming sectors of the output of a given sector. Each row of equation 2.1 shows the direct distribution (the demand) for the commodity

of that sector between the various intermediate and final demands. The total direct plus indirect demand for commodity k by sectors is given by the terms of row k in the expression $(I - A)^{-1}y$ of equation 2.5. Once this is known, the second and third criteria may be applied.

The second criterion relates to how effectively policies could be developed to spur the necessary additional final demand. This ability would depend upon the number and identity of the consumers and the characteristics of their demand for the commodity of that sector. The number and identity of consumers would include such factors as whether the consumers were public or private, individual or corporate. The characteristics of demand would likely include such things as income and price elasticity, existence of substitutes and complements, the changeability of preferences and tastes, etc.

The third criterion is more difficult to understand because the concept of economic development is complex. If a country has a development plan, the plan probably places more or less emphasis on the several sectors. Reasons for special emphasis may include such objectives as self-sufficiency in necessities, reducing unemployment, and national security. Because of the key role that capital plays in economic development, the investment sector is likely to receive great emphasis. Other than the standard argument of the importance of investment for economic development, the use of the forward and backward linkages as conceived by Hirschman would assist in determining sectors to emphasize to promote development (34, Chapter 6). Hirschman uses the input output framework to qualify the linkage effects. Forward linkage is the percent of the total demand comprised by interindustrial

demand. Given n sectors, i.e., the dimension of Q is n x n, forward linkage of sector k is defined as $100 \sum_{j=1}^{n} \frac{Q_{jk}}{q_k}$.

If class I aid imports substitute for domestic production, there are direct effects on the system. There are again two approaches as in the case of class III aid imports. The sectoral outputs without aid are shown by equation 2.5. Recall the Q_i^{1a} is the quantity of class I imports. The sectoral output with the aid substituting for domestic production can be determined from equation 4.12. The elements of vector y^{1a} are set equal to the elements of sector y of equation 2.5 except for y_i^{1a} which is set equal to the difference $y_i - Q_i^{1a}$. The effect of the aid, q^a, is the difference, $q - q^{1a}$, between the sectoral output levels with and without aid.

The alternative approach of calculating the sectoral output effects directly employs equation 4.4. Set all elements of y^a equal to zero except y_i^a which is set equal to $-Q_i^{1a}$. Then the value of q^a can be obtained. The relationship between the two approaches is again by equations 4.5 and 4.6.

The substitution of class I aid imports for commercial class I imports can also occur. In this case there are no direct effects which can be analyzed by the input-output technique. The analysis of the indirect effect is the same as that of class III aid imports substituting for class III commercial imports and is not repeated here.

Class II Aid Imports

When aid is in the form of food it is not likely to meet the requirements of class II because it will probably be competing with domestic production. However, inputs into the agricultural sector as a suggested form of aid by the World Food Program may well satisfy the definition of class II imports (9, pp. 16-17). To cover the possibility of aid of that type, the analysis of class II imports is included.

The imports of this class may be included in a row similar to that of the value added row in the input-output table. Each column in the transactions table together with the value added sector, i.e., matrices Q and V, represent a production function with a corresponding total output for that sector. This production function may be represented as equation 4.13 which is the production of sector j.

$$(4.13) \qquad q_j = f(Q_{1j}, Q_{2j}, \ldots, Q_{nj}, M^2_{(n+1)j}, V_{(n+2)j})$$

In equation 4.13, $M^2_{(n+1)j}$ is the quantity of class II commercial imports and $V_{(n+2)j}$ is the quantity of primary inputs. In an input-output production function there is no factor substitution and the inputs are directly proportional to the level of output. Thus, if class II imports are introduced into equation 4.13, either they must displace the $M^2_{(n+1)j}$ imports or the level of output of the sector, q_j, must rise by $100\left(\frac{M^{2a}_{(n+1)j}}{M^2_{(n+1)j}}\right)$ percent where $M^{2a}_{(n+1)j}$ is the quantity of class II aid imports into sector j. In absolute terms the increase in q_j

is $M^{2a}_{(n+1)j}\left(\frac{q_j}{M^2_{(n+1)j}}\right)$.

The substitution of aid for commercial imports is contrary to just principles of international trade. Therefore, the implications of the rise in the level of output of the sector using the aid are analyzed. Since the level of output needed to absorb the additional imports is known, the unknown is the required level of final demand. Because remaining inputs other than the inputs of aid are necessary for production, the levels of output of other sectors are also required to rise. The demand for some sector must rise if the output of the sector using the aid imports, sector j, rises. First, as the simplest case, suppose the final demand for sector j rises. The level to which it must rise can be found using equation 4.14 with the fixed levels of final demand of all other sectors and the total output of sector j.

$$(4.14) \qquad q^{2a} = (I - A)^{-1} y^{2a}$$

Let the system without aid be given by equation 2.5. Then in equation 4.14 set q_j^{2a} equal to $q_j\left(1 + \frac{M^{2a}_{(n+1)j}}{M^2_{(n+1)j}}\right)$ and let all other elements of q^{2a} and y_j^{2a} be endogenous. Let the exogenous y^{2a} variables have the same value as those of y in equation 2.5. The difference between the results of equations 2.5 and 4.14 is the effect of the aid imports. Remember that $(I - A)^{-1}$ must be adjusted when variables are interchanged.

The approach of calculating the effects of the aid separately is given by equation 4.4. In equation 4.4 set q_j^a equal to $M^{2a}_{(n+1)j}\left(\frac{q_j}{M^2_{(n+1)j}}\right)$ and the elements of y^a equal to zero except that y_j^a is interchanged with q_j^a and is endogenous. Then equation 4.4 will give the effect of the class II aid imports on the output of all sectors except sector j for which the required rise in final demand is given. The result is consistent with the first approach.

There is no need to force the final demand to change in only sector j. It may be desirable to fix it and solve for the final demand of some other sector in a procedure similar to that discussed for class I imports above.

There are no direct impacts upon the input-output model if class II aid imports substitute for class II commercial imports. Again there may be indirect effects but their analysis is the same as that of the substitution of class III aid imports for commercial imports and is not repeated here.

Class IV Aid Imports

The implications derived directly from the model of class IV imports in the form of aid are quite limited. There is no direct relation either through competition with domestic production or intermediate demand which utilizes the analytical power of interindustry analysis. However, some implications can still be made, especially concerning international trade and the relative composition of the final demand of the several sectors.

Like the other three classes of aid, class IV imports again require a look at international trade. Since class IV imports are non-competing, they result in a one-for-one substitution for commercial imports unless demand is expanded. Therefore, the approach of expanding demand receives the greatest concentration and is discussed below. The analysis of the indirect effects of such a substitution is similar to that for the class III imports discussed above.

The approach of expanding demand requires expanding final demand because class IV imports are not used in intermediate demand. The next chapter is devoted to the policies of demand expansion. When the demand for the class IV aid imports, or any other particular commodity, is expanded it is likely that the demand for other commodities will also rise unless very restrictive policies are placed and enforced upon their consumption. This can be related back to the input-output model by an exogenous rise in the y vector. The effect upon production at constant prices can be determined by the now familiar equation 2.5.

Common Characteristics and Synthesis of Aid Imports

The four classes of imports have been considered separately. This section will bring together their common characteristics and give a synthesis of all four classes in the model simultaneously.

Consistency of an economy can only be maintained for each of the four classes of aid imports through either a substitution for commercial production (domestic, foreign, or both) or demand expansion. The former is undesirable except in special situations where a switch in the product mix of the recipient promotes development. Although undesirable,

there is reason to believe that it does occur and therefore its analysis is incorporated into the model. The effects of classes I and III imports must be a mixture of substitution for domestic production, substitution for commercial imports, and expansion of final demand. The effects of classes II and IV must be a mixture of substitution for commercial imports and expansion of final demand. These are not surprising conclusions. But the use of the methods above provides more. It gives a means of determining the quantitative effects, helps to avoid inconsistencies, and provides insights into all available alternatives for absorbing aid.

It may appear that certain impacts of aid have been omitted because a two or more stage substitution could occur. For example, the aid may substitute for domestic production which in turn substitutes for commercial imports. However, the ultimate effect of the two stages is the substitution of aid for commercial imports. Because the ultimate effects of the multi-stage substitutions are the same as one of the single-stage substitutions, their analysis has not been separately provided.

For simplicity, the required expansion of final demand was shown for only an expansion of one sector. This is somewhat unrealistic because the demands of all the sectors are related through prices and preferences. Exogenous changes in the final demands for other sectors can be made to reflect the estimated relative sectoral demands. By experimenting with several sets of these exogenous changes, an acceptable approximation of the final demands can be attained given the required level of one of them and their relative positions. This approach of

experimenting with exogenous changes in final demand has been suggested throughout the chapter as a means of approximating what has been called the indirect effects of aid on sectoral outputs.

Separate methods were presented for the analysis of aid substituting for commercial imports, substituting for domestic production, and satisfying an expanded demand. The input-output technique is more versatile. It can be used to analyze a combination of the three types of effects. For example, ten bushels of wheat aid may result in three bushels substituting for commercial imports, two bushels substituting for domestic production, and five bushels satisfying an expanded demand. First determine the separate effects of three bushels substituting for commercial imports, two bushels substituting for domestic production and five bushels satisfying an expanded demand. Then simply aggregate the three impacts to get the impact of the ten bushels. This procedure would be very useful for the ex ante analysis of aid. It provides empirical results which can be used to formulate policies for the distribution of the aid. Either the approach of finding a new solution for the economy or the approach of finding the changes caused by the aid may be used. If the former is used, the changes caused by the aid can be determined by subtracting the solution for the economy with aid from the solution without aid. If the latter is used the changes caused by the aid may be added to the solution for the economy without aid to find the solution with aid.

Aid to a country may be a mixture of several commodities. The commodities may in turn be classified into several sectors, depending on the definition of the sectors. The aid classified in each sector

may be analyzed separately. Then the results of the separate analyses can be aggregated to obtain the total effect of the aid. The relationship between the approaches of finding a new solution for the economy vs. finding the effects of the aid are the same as in the previous paragraph.

The methods above employ a separate calculation for each group of commodities classified into a sector and for each possible effect--substitution for domestic production, substitution for commercial imports, and demand expansion--which they may have. The single calculations can be combined into one so long as each variable that is exogenous (endogenous) in one is exogenous (endogenous) in the others. The changes in the exogenous variables for each of the calculations can be added together and one solution found for the endogenous variables incorporating all the changes. This aggregation can be performed because the vectors q and y may each be separated into several vectors and then reaggregated so that only one solution of the model is required. If the exogenous-endogenous role of one or more of the variables is reversed in the separate calculations, those separate calculations can be grouped so that the roles of the variables are identical in each group. A solution for each group of separate calculations can be obtained as described earlier in the paragraph. Finally, these group solutions can be aggregated to obtain the combined result of all the separate calculations. Again, the relationship between the approaches of finding a new solution for the economy vs. finding the effects of the aid are the same as described above.

Caution should be exercised when a decision is made to reduce the number of solutions by combining the separate calculations. While the

quantity of numerical computations is reduced, the information obtained is also reduced. When the calculations are made separately, the cause of each effect is identified. When the calculations are grouped, the effects of the several causes cannot be isolated. For policy purposes it is desirable to identify the cause of specific effects. Consequently, in most cases, the small gain of a reduction in the required number of computations is more than offset by the loss of information.

CHAPTER V. ELIMINATING THE NEGATIVE EFFECTS OF COMMODITY AID

Elimination of Losses through Resource Compensations

A correct international decision on the amount of aid requires all losses be reflected. But that has been the ideal rather than the practice. One method of accounting for these losses is for the donor or the recipient to compensate for them. Whether or not this can be done depends upon the identification of the losses. The assumption of constant prices which underlies the input-output analysis above is dropped so that the identification of the losses can be made more precise. Dropping it also permits the consideration of more flexible policies to eliminate the losses.

Before presenting the arguments, a brief statement on the methodology of what follows is required. The introduction of prices commands attention be given to the several markets of the recipient and in some cases even the world. To expedite the analysis, it is assumed that the aid commodity is classified into a market for a composite commodity, called the aid composite good, comprised of the good homogeneous with that of the aid and its "substitutes." The "substitutes" are those goods whose use can be displaced by the aid commodity and whose price declines, when there is aid compared to when there is not, imposing a lower real return upon resources committed to their production and distribution. Note that the aid composite good does not include those goods whose demand declines because of the price effects but who have that decline at least or more offset by the income effects of the aid. Neither does it include the inputs into the aid composite good. If there are inferior goods

it is undesirable to include their decline in demand caused by the increase in income because it would result from any real income increase and not just those which stem from commodity aid.

The construction of the unit price and unit quantity of a composite good must be such that the product of its quantity and its unit price equals its value. Let the value be the sum of the values of the several commodities which comprise it. Then arbitrarily select a unit price or a unit quantity. If a unit price (quantity) is selected the unit quantity (price) is the ratio of the sum of the value of the several goods to the unit price (quantity). The ratio of the value of one of the goods to the arbitrary unit price (quantity) is that good's unit quantity (price) expressed in terms of the composite good. A large shift in the mix of the composite good may cause substantial changes in the relative prices of its several goods. However, the quantity of aid is often relatively small or marginal and hence that problem can generally be ignored.

This definition of the market associated with the aid commodity consolidates the negative effects of aid and enables the discussion to be based largely on the division of the aid composite good and other commodities. The effects of aid are viewed in the comparative static sense of an equilibrium situation without aid and an equilibrium situation with aid. To travel from one situation to the other, the discussion employs the dynamics between the two. A distinction is made between a commercial and a concessional (differentiated) market. Specific government policies establish the latter while the former occurs without government involvement.

The imposition of losses resulting from aid hinges on the price of the aid composite good in the commercial market, i.e., the commercial price. That commercial price will decline unless one or more of these unlikely circumstances prevail. They are (1) a horizontal demand curve, (2) a horizontal supply curve, or (3) a rightward shift in the total demand curve of the aid composite good. Neither a demand curve with a positive slope less than the slope of the supply curve nor a supply curve with a negative slope algebraically less than that of the demand curve is considered because of the severe circumstances it implies. If either does occur the market will be unstable unless it does not follow Walrasian behavior described by Henderson and Quandt (33, p. 110).

In reality a demand curve is not likely to be horizontal because it imposes severe restrictions on individual preference functions. Likewise, a supply curve is not likely to be horizontal. That would imply the resources used to produce the aid composite good have an opportunity cost equal to the return they earn in the production of the aid composite good. The extent of demand expansion depends upon the method used to distribute the aid in the recipient country. For the moment, it is assumed that demand does not shift to the right by the amount required to prevent a decline in the commercial price of the aid composite good. Later in the chapter it is shown that special policies are required to induce the required shift.

If the commercial price of the aid composite good does fall, losses are imposed on the owners of the resources which continue to produce it. Losses may also be imposed on the owners of the resources which shift employment to the production of other commodities. However,

some of these resource owners, probably not all, may gain because the aid increases the opportunity cost of their resources above what it was prior to the aid. Hence, these resources can earn a greater return producing other commodities with aid than they could earn producing the aid composite good without aid. They gain because the income increase resulting from the aid shifts the demand for other commodities to the right. Not all of the resources which shift to the production of other commodities as a result of aid are likely to gain a greater return. Some probably shift to minimize losses. The extent of such a shift depends on the flexibility of the resources and the magnitude of the changes in the demand for other goods. The flexibility of the resources is their ability to be technically efficient in alternative employment and the willingness of their owners to seek the alternatives.

Thus, the depressive impacts of commodity aid on the commercial market of the aid composite good can be of two types. One is a decrease in the quantity marketed and the other is a decrease in the market price. In reality both price and quantity probably decline when commodity aid occurs. Constant prices underlie the input-output methods of the previous chapter. Therefore, those methods measure the losses as decreases in the quantities marketed. The losses measured as quantities could be compared to the estimated losses encountered if the price were permitted to decline and both the supply and demand functions were known. In any case, losses are imposed unless special policies are in force to expand final demand.

The effects of the losses do not, of course, end with the immediate owners of the resources used in the production of the aid composite

good. The input industries of the commodities whose production declines (rises) experience a decrease (increase) in the demand for their goods and services. The owners of the resources used in these industries which earn lower (higher) returns will likely reduce (increase) their purchases for consumption and investment. Although these impacts may be small, the precise identification of the losses requires a most elaborate general equilibrium model. Such models may be possible to construct for a theoretical analysis but are not feasible for applied numerical analyses.

Not all of the negative effects of commodity aid will necessarily be within the recipient country. If the aid composite good is commercially imported or if any of its inputs or inputs into their inputs, etc., are commercially imported, the losses to producers and resource owners will echo and reverberate in the international trade markets. Some of the effects will reflect back to the donor resulting in gains and losses to his members.

One means of identifying the losses so they can be compensated is establishing a resource retirement program. Such a program offers the owners of resources a return equal to what they would earn without the aid. To prevent the owners from falsely claiming a loss, the program requires the resources to be idle if they collect the subsidy. Formulating such a program at a practical level is a difficult task as evidenced by U. S. farm policy. As suggested by the input-output methods of Chapter IV, the program can not apply solely to the resources which flow directly into the production of the aid composite good because intersectoral dependence of the economy creates indirect effects.

The implications of such a resource retirement program are not acceptable. Besides the horrendous administrative implications, it has the effect of shifting the unused resources from the donor to the recipient and his trading partners. If the donor gives the aid as a surplus disposal scheme, the political acceptance of such idle resources in a developing country is doubtful. Even if not, the task of making it effective requires the resources of skilled administrators which are generally in short supply. While there are no doubt benefits to the consumers of the aid, a program for direct subsidization does not readily permit the identification of the losses and their elimination. A more direct approach would be for the donor to pay its own producers not to produce.

Elimination of Losses through Price Maintenance

A price maintenance policy eliminates the negative effects transmitted through the commercial market without requiring the identification of particular losses. The revenues needed for such a subsidization policy can be raised from the aid by maintaining a higher selling price for the aid commodity in the recipient country than the price paid the donor. The commercial price of the aid composite good is subsidized at its equilibrium level were there no aid. Since the effective commercial price does not decline, there are no losses imposed through it. The revenue available for the program is the product of the quantity of the aid and the difference between the aid commodity's selling price and its cost from the donor. The costs of the program include the administration and the product of the quantity of the aid composite good

commercially marketed when its price is subsidized at the level which prevails without aid times its price decline consequential to the aid.

The quantity of the aid composite good producers choose to supply at the price which prevails without aid may not be the same with and without aid. Recall that some resources may leave the production of the aid composite good for more gainful employment elsewhere because of a greater demand for other goods. The increase in the demand for other goods depends on the real income effects generated by the aid. It is shown in the next section where a differentiated market prevails that the lower the selling price of the aid the greater its income effect. If the aid is given away the greatest income effect occurs and the greatest increase in the demand for other commodities which are not inferior goods results. But alas, if the aid is given away no revenue is generated to fund the price maintenance program even when the donor provides the aid as a pure grant. If the aid is sold at some price greater than the donor's selling price, revenue is raised but the demand increases resulting from the income effects are less.

The analysis in this section assumes that aid is distributed through the commercial market. If this were not the case, the recipient would require a differentiated market which is discussed in the next section. When aid is distributed through the commercial market, the maximum price is received for it and the revenue for price maintenance is maximized while the demand increases are minimized.

An actual experiment is probably necessary to determine with reasonable precision the quantity of the aid composite good commercially supplied with aid if its price were subsidized to maintain it at the

level which would prevail without aid. However, its upper limit is the equilibrium quantity supplied without aid. Assuming that this upper limit is supplied, certain requirements can be established to show when a subsidy program of price maintenance is acceptable. For the present analysis the monetary effects of aid are ignored. It is shown later in the chapter that these effects are indeterminent and likely to be small unless the revenue from the sale of the aid is hoarded.

Ignoring the administration costs, the program is acceptable only for certain relationships between the demand price elasticity of the aid composite good, E_D; the donor's unit selling price of the aid commodity, P_a; the equilibrium price, P_1, of the aid composite good resulting when the aid supply, ΔS, is added to the equilibrium commercial supply of the aid composite good, S, were there no aid; and P, the price associated with S. The values for P_a and ΔS are based on the measurement of the aid commodity in units of the aid composite good. The analysis implies the aid commodity and the aid composite good have the same price when measured in units of the aid composite good. This is precisely the result obtained if the unit price and unit quantity of the composite good are constructed as suggested above.

The requirement that the program yield a net revenue is given by inequality 5.1. It can be rearranged into inequality 5.2 because both S and $(P - P_1)$ are positive. Now 5.2 may be rewritten as 5.3.

(5.1) $\quad \Delta S(P_1 - P_a) > S(P - P_1)$

$$(5.2) \qquad \frac{\Delta S}{S}\left(\frac{P_1}{P - P_1}\right)\left(1 - \frac{P_a}{P_1}\right) > 1$$

$$(5.3) \qquad \frac{\Delta S}{S}\left(\frac{P}{P - P_1}\right)\frac{P_1}{P}\left(\frac{P_1 - P_a}{P_1}\right) > 1$$

In 5.3 $(P - P_1)$ is the drop in price when the supply rises from S to $(S + \Delta S)$, and it could be written as ΔP. Then inequality 5.4 is derived by substituting $-E_D$ for the left two factors of inequality 5.3. Finally,

$$(5.4) \qquad -E_D\left(\frac{P_1 - P_a}{P}\right) > 1$$

inequality 5.5 is obtained by dividing both sides of inequality 5.4 by $\frac{-(P_1 - P_a)}{P}$. Hence, for the program of price maintenance to be acceptable, inequality 5.5 must hold.

$$(5.5) \qquad E_D < -\frac{P}{P_1 - P_a}$$

The ordering of the three prices is given by inequality 5.6 which implies inequality 5.7. If the price of aid, P_a, is zero, inequality 5.5

$$(5.6) \qquad P > P_1 > P_a \geqq 0$$

$$(5.7) \qquad 1 > \frac{P_1}{P} \geqq \frac{P_1 - P_a}{P} > 0$$

reduces to inequality 5.8. Since P is greater than P_1, inequality 5.8 states that E_D must be less than -1. If P_a is such that equation 5.9

$$(5.8) \qquad E_D < -\frac{P}{P_1}$$

$$(5.9) \qquad P_a = P_1 - \frac{P}{2}$$

holds, E_D must be less than -2. The implication is clear that unless the aid is nearly a pure grant and the demand for the aid composite good is elastic, the price maintenance proposal must be rejected on an economic basis.

This analysis is readily applicable because of the definition of the aid composite good. However, the analysis can be considered for the case where the above symbols apply only to the aid commodity. The effect on the substitute commodities is momentarily ignored.

Unfortunately there are no empirical studies available on price elasticities for commodities in the less developed countries. For the argument here, a characteristic of demand proven by Wold and Jureen (69, p. 111) and elaborated on by Frisch (29) is adequate to show the subsidization scheme given above is not acceptable. This characteristic of demand is that the price elasticity equals the negative of the income elasticity and all cross elasticities. Since there are empirical studies on income elasticities and some intuitive qualifications may be placed on cross elasticities, implications can be made for the value of the price elasticities.

Mellor uses the relationship between the elasticities and argues that "because the cross elasticities will be greater the closer the substitutes, we can expect that the price elasticity would be higher

than the income elasticities for individual food grains such as wheat or rice, while the two elasticities will have values much closer to the same absolute level in the case of food grains as a total group" (44, p. 72). Mellor uses an income elasticity of 0.8 as representative of a low income country to argue that the price elasticity is about -0.9 for agricultural products (44, pp. 72, 75).

The argument employed here, however, requires greater restrictions. If the cross elasticities are nonzero, then a reduction in the price of the aid commodity may impose losses on the substitute commodities. For the subsidization program to be acceptable, these losses must be taken into consideration. One way of doing so is to have policies to make the effective cross elasticities equal to zero. Then for the subsidization program to be acceptable, the income elasticity must exceed 1.0 which is substantially greater than Mellor's estimate and seems most unlikely. A second approach is to compensate the producers of the substitute commodities. But this means that E_D would need to be even smaller so that funds would be available from the sale proceeds of the aid to compensate the producers of the substitute commodities.

Even if an economically feasible price maintenance policy could be established, most of the revenue from the sale of aid would be required for subsidization of the production of the commodity. That means nearly all the accomplishments of the aid would be in the form of increased consumption of the aid commodity. One would usually hope to accomplish more than this through aid.

Given the relationship between the quantity of aid and the decrease in the commercial supply of the aid composite good which occurs when its

commercial price is maintained, the above relationships can be modified. Recall that this shift of resources occurs because the income increase resulting from the aid shifts the demands and raises the opportunity cost of these resources. Let X be the ratio of the decrease in commercial supply of the aid composite good to the quantity of aid, ΔS. Then $(1-X)\Delta S$ and $(1-X)E_D$ can be substituted for ΔS and E_D in the above inequalities to allow for the shift in resources resulting from the rise in income. Generally X would be non-negative. Inequalities 5.5 and 5.8 show that the shift in the employment of resources results in a less stringent relationship between the price elasticity of demand and the several prices. Regretably short of an actual experiment there is probably no means of estimating X.

A similar but less restrictive condition could be derived for the case of subsidizing only the commercial imports and not the domestic production of the recipient. Such a policy is unacceptable because it does not compensate all negative impacts on the commercial market resulting from commodity aid.

In summary, the feasibility of a price maintenance program depends on the demand price elasticity of the aid composite good, the donor's selling price, the distribution price, shifts in the demands of all commodities, the flexibility of resources, and the program's administration costs. This long list is difficult to estimate. However, the empirical evidence that is available suggests that unless much of the aid is offset by a shift of resources away from production of the aid composite good and unless the aid is substantially a grant, the program is not feasible.

While there are certainly benefits for the consumers of the aid composite good, the losses are not efficiently eliminated with a simple price maintenance policy.

Elimination of Losses through Demand Expansion

Since the negative effects of food aid on the commercial market are not readily eliminated by compensating displaced resources or establishing a simple price maintenance program, alternative approaches must be sought. The one most often prescribed is expansion of demand for the aid commodity in the recipient country. Demand expansion of the aid composite good is required if all the losses are encompassed. There are two potential types of demand expansion. One is through the commercial market and the other is through noncommercial or concessional markets. Expanding the commercial demand for the aid composite good requires a redistribution of income in the recipient country. Income must be transferred from those with a low income elasticity for the aid composite good to those with a high income elasticity for it. Those policies which do this in the most economically efficient way, that is without disrupting resource allocation, are lump sum transfers. However, the cost of administration and the possible adverse effects upon investment by such transfers make such policies difficult or undesirable in the less developed countries.

The other means of demand expansion is to establish a concessional market for the aid composite good. An effective concessional demand must completely absorb the greater supply of the aid composite good without reducing the commercial demand. The greater supply equals the

quantity of aid less the decrease in commercial supply caused by the reallocation of resources because of the rise in the demand for other goods. This decline in the commercial supply eventuates when the commercial price is maintained at its equilibrium level without aid. As argued above the extent of this decline in the commercial supply cannot be readily estimated. Therefore, to facilitate the discussion, it is momentarily assumed that there is no shift at all. The monetary effects are ignored again also.

Although a distribution scheme with a concessional demand is not likely to absorb all the aid, it is conceivable such schemes will absorb a major part of it. This is argued by Fisher (20, p. 866) and proclaimed by Rogers in the case of India (56, pp. 116-137). Although Fisher and Rogers do not use the aid composite good concept, they somewhat approximate it by using food and cereals respectively for the analysis of U. S. agricultural commodity aid. The food aid supplied is partially absorbed by a greater total (commercial plus concessional) demand for the aid composite good because of the income effect of purchases of it at lower prices in the concessional market.

It is argued above that a similar income effect occurs if the aid composite good is distributed through the commercial market. To compare the magnitude of the two effects, the following symbols are used:

P market price of the aid composite good resulting when aid is distributed through the commercial markets,

S commercial supply of the aid composite good resulting when commodity aid is distributed through the commercial markets,

F quantity of aid measured in units of the aid composite good,

P_f price of the aid composite good in the concessional market,

P' price of the aid composite good in the commercial market coexisting with the concessional market,

S' quantity of the aid composite good supplied in the commercial market coexisting with the concessional market.

The income spent for the aid composite good when it is distributed through the commercial market is $SP + FP$. The income spent for the commodity when it is distributed through the concessional market is $S'P' + FP_f$. This again implies the aid commodity and the aid composite good have the same price when measured in units of the aid composite good. As shown above this is consistent with the concept of the aid composite good and presents no problem. A concessional market implies that P_f is less than P and thus FP_f is less than FP. This implies that income after purchases of the aid is greater when aid is distributed through a concessional market rather than the commercial market. The lower the P_f the greater the income effect. With the greater income, more of both the aid composite good and other commodities will be purchased if their income elasticities are positive. When the aid is distributed through the commercial market only the demand for other commodities shifts because the income effect resulting from the lower commercial price is by definition incorporated into the demand curve. It is assumed that the income elasticity of the aid composite good is positive. Thus, if supply is fixed (in the short term), P' is greater than P; but if supply is not fixed, probably both P' is greater than P and S' is greater than S, since supply is likely to respond to higher prices. The response of supply to the higher price may be offset by the increased opportunity cost of the resources in the production of

other goods because of the greater income effect. However, this implies an additional rise in P'. Ultimately, S'P' is greater than SP if the income elasticity is positive. Thus, distribution of aid through a concessional market has a smaller negative effect upon the commercial market than does distribution of aid through the commercial market. To establish a concessional market, a differentiated market or rationing of some type must of course be introduced.

A differentiated market would permit some consumers of the commodity to purchase it at a lower price. This selects some consumers to receive a benefit while others do not. Those who do not receive the benefit of purchasing it at a lower price may complain of their status. From a position of equity, their complaint may be legitimate, but they have lost nothing they previously possessed. In economic jargon, the distribution of aid through a differentiated market is a pareto optimum for the community of purchasers of the aid composite good.

However, the position of the sellers in the commercial market is not nearly so favorable. The discussion of the impact of aid usually implies that the price elasticity of supply is not zero. This implication follows from the statement that a decrease in the price of the aid commodity will reduce the commercial production. Here it is assumed that the supply of the aid composite good has a positive price elasticity. Under that assumption the only way to prevent a decline in the price and quantity supplied in the commercial market is to prevent any decline whatsoever in the quantity demanded at the commercial market price which would result if there were no aid. Keep in mind it is momentarily assumed that resources are not reallocated because of a shift in opportunity costs.

Then the quantity demanded in the commercial market concurrent with a concessional market must be equal the quantity demanded were there no concessional market. That is most unlikely. It implies that precisely 100 percent of the increased income (the aid) is consumed in the form of the aid composite good. That is, the aggregate marginal propensity to consume the aid composite good is unity.[1] This clearly conflicts with the theoretical and empirical body of economic knowledge. It needs no further consideration. If consumers receiving aid paid a concessional price for it, i.e., did not receive it gratis, or if they otherwise transferred all or part of their increased income to other consumers, the same devastating conclusion follows. The marginal propensity to consume the aid commodity from the transferred income needs to be unity.

The alleviation of the negative effects of aid on domestic output through price subsidies when there is a concessional market is not discussed here. Fisher has already discussed them without the concept of the aid composite good (20, pp. 869-873). His analysis should not be confused with that of the previous section where the same question was answered for circumstances void of a differentiated market.

A differentiated market does expand the market for the aid composite good but if the quantity distributed through it is no greater than the quantity of aid, it cannot expand demand sufficiently to eliminate all the negative effects. The assumption that there is no reallocation of resources from the production of the aid commodity to other commodities

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[1] Marginal propensity here is average marginal propensity or incremental propensity if the quantity of aid is more than a small differential increase in the consumers' consumption level.

can be dropped. If reallocation does occur, the potential of eliminating the negative effects of aid is improved. Rogers reaches a favorable conclusion for a differentiated market based on his empirical results for P.L. 480 aid to India (56, p. 218). He concludes only 7 percent of the aid displaces the commercial cereal market. Though admirably small, it still is a negative impact. The discussion will return to his results in the next section.

A New Approach to Demand Expansion

A new approach to demand expansion which overcomes the limitations of previously suggested schemes will now be presented. It requires a differentiated market in which the price of the aid composite good is less than it is in the commercial market. The program is based on income effects which result from a concessional market. The program requires the purchase of appropriate quantities of the aid composite good in the recipient's commercial market and the channelling of it through the concessional market.

Again the monetary effects and resource reallocation resulting from demand shifts are momentarily ignored. The amount purchased in the recipient's commercial market depends upon the extent the aid composite good in the concessional market diverts purchases from the commercial market. Let r be the ratio of the quantity of the aid composite good in the concessional market which displaces commercial sales to the quantity of aid, F, measured in units of the aid composite good. In other words, 1 - r is the incremental propensity to consume the aid composite good with the income increase resulting from purchasing of the aid composite

good through the concessional market. Then rF units of the commercial market are displaced. However, the total quantity marketed (commercial plus concessional) has expanded by F - rF or (1 - r)F. This is less than desired. Indeed, since no loss is to be inflicted, final demand must be increased by F. Therefore total demand needs to be expanded by rF more units. Because F units of flow through the concessional market expand demand by (1 - r)F units, $\frac{1}{1 - r}$ units of flow expand demand by one unit. Then $\frac{rF}{1 - r}$ units must be purchased in the commercial and distributed through the concessional market to expand demand by the necessary additional quantity. The analysis here assumes linear relationships but there is no reason why it cannot be adjusted to the general case. In the general case the ratio of the quantity of aid, measured in units of the aid composite good, to the total quantity required to flow through the concessional market to expand demand must be 1 - r.

The cost of operating such a program is equal to the administration cost plus the product of the quantity purchased in the commercial market and distributed in the concessional market times the price differential between the two. Let P and P_f be the prices in the commercial and concessional markets respectively. Then the cost equals $\frac{rF}{1 - r}(P - P_f) + C$ where C represents the administrative costs.

It is useful to rewrite $\frac{r}{1 - r}$ as $\frac{1}{1 - r} - 1$. The cost excluding administration then becomes $F(\frac{1}{1 - r} - 1)(P - P_f)$. Clearly the greater P_f,

other things equal, the smaller the cost, excluding administration. The gross revenue of such a program is FP_f. The greater P_f the greater the gross revenue, ceteris paribus. The upper limit of P_f is P because if P_f equals P there is no income effect which will shift the total demand to the right. Consequently, P_f should approach P if the net revenue from the aid is maximized. Also from the cost expression, it is clear that the greater 1 - r the smaller the cost, ceteris paribus. Hence, the concessional market should be designed to maximize 1 - r if net revenue from the aid is maximized. There may be a dependence between P_f and 1 - r such that if 1 - r is maximized, P_f cannot be as close to P as it is for other values of 1 - r. Also, the administration costs may rise as more effort is employed selecting optimal values for P_f and 1 - r.

The P_f is a policy instrument and its selection is a policy question. The smaller it is, the greater its income effect for those who have access to the concessional market. If the good in the concessional market is not precisely homogenous with that in the commercial market (since they are issued in different markets they are not likely to be perfectly homogeneous) P_f may need to be somewhat less than P to entice the required flow of commodities through the concessional market.

The value of 1 - r depends on the design of the concessional market. Recall 1 - r is the incremental change in quantity purchased to the increase in income and, ceteris paribus, maximizing net revenue from the program requires maximizing 1 - r. The greatest increase in the aggregate 1 - r is achieved by giving the greatest income increases to those with the largest individual values of 1 - r. The individuals who receive the initial and hence probably the greatest increase in income are those who

have access to the concessional market. Hence those individuals with the largest individual values of 1 - r should have access to the concessional market. In general, an individual's 1 - r is associated with his income. In the case of food, the individuals with the greater values of 1 - r are those with low incomes. Here the goal to gain the greatest net revenue is in agreement with welfare goals to give food to the poor. In contrast, consider clothing instead of food. The individuals with the largest propensity to consume clothes are not likely to be the very poor because they have a basic need to satisfy their hunger; those with greater incomes do not. In the case of clothes, the welfare goal may conflict with the desire to maximize the net revenue of the program.

Briefly consider the cost of this program compared to that of distributing the aid through the commercial market. The cost of administration for the former is likely to be greater than that for the latter; however, for the moment they are ignored. To simplify the comparison, assume that P_f is fixed at the same level as the price resulting from distribution through the commercial market. In both cases the gross revenue is FP_f. The difference between the net revenues of the two programs is the added cost of the former. The value of 1 - r is related to the income elasticity of the good, e_y, as expressed in equation 5.10 where Y is income and Q is the total quantity of the good consumed. The relationship derives from the fact that the income

$$(5.10) \qquad 1 - r = e_y \frac{Q}{Y}$$

elasticity equals the marginal propensity to consume divided by the average propensity to consume. Consider the case of food. As reviewed above, Mellor argued that the income elasticity of agricultural products in low income countries is about 0.8. For such commodities one expects the marginal propensity to consume to be less than the average propensity. Rogers reviews the empirical studies on food consumption (56, pp. 80-88) and it is clear that an income elasticity of 0.6 and an average propensity to consume of 0.5 are not unreasonable estimates for low income countries. They imply a value of 0.3 for 1 - r and a cost to the new program presented here equal to $2.33F(P - P_f)$. The importance of selecting P_f close to P and maximizing 1 - r is now obvious. If the ratio of P_f to P is 0.8 the cost of the program is 58.25 percent of the gross revenue. If the income elasticity were 0.8 as Mellor has suggested (44, p. 72) and if the average propensity to consume were 0.6, then the cost would only be $1.10F(P - P_f)$. If the ratio of P_f to P is again 0.8, the cost of the program is equal to 27.5 percent of the gross revenue. In general, the program shows a net revenue, excluding administration costs and the cost of the aid from the donor, if inequality 5.11 holds. The interpretation of a low net return to the program, when its administration

$$(5.11) \qquad (1 - r)P > P - P_f$$

is efficient, is not that it is an inefficient means of distribution but that the aid is not very valuable to the recipient.

The magnitude of r may have a substantial variation from country to country and program to program. In the case of the fair price shops in

India, Rogers' calculations appear to imply that r has a magnitude of about 7 percent (56, p. 134). If true, the quantity of food to be transferred from the commercial to the concessional market is 7.53 percent of the quantity of foreign food aid. Keep in mind that Rogers did not account for all the negative effects of the cereal aid because he did not use the concept of the aid composite good. Rather he only accounted for the effects in the cereal markets. The price in the fair price shops ranged from 50 percent to 100 percent of the commercial market price (60, p. 144). With that price range, the cost of the program would range from only the administration costs to the administration costs plus 3.76 percent of the value of the foreign food aid when it is valued at the recipient country's commercial price.

Who should pay for such a demand expansion program? There are two basic candidates, the donor and the recipient. In the case of the U. S. P.L. 480 program which formerly made partial or total sales for local currency, the U. S. could fund the additional cost with the unwanted stocks of local currency which have accumulated. In other cases the donor would have to obtain the foreign currency of the recipient in order to fund the program. This would increase the foreign exchange available to the recipient and help relieve what is likely a strong constraint on the recipient's economic development. The donor is likely to finance the program through its taxation which it uses for financing general foreign aid. But if the donor simply raises the price or terms of the aid to offset the cost, it would in effect be transferred to the recipient. If the recipient pays the cost, it is essentially a question of income transfers from those who fund the cost through

higher concessional price, taxes, or whatever, to those who suffer losses in the commercial market.

The welfare of those who regularly buy in a concessional market is no different unless the price in the concessional market is changed to cover the cost of the program. Either the number of consumers who have access to an existing concessional market would increase or those who have access to it would acquire more from it. There would be no direct effect upon the consumers who buy in the recipient's commercial market compared to when there is no food aid at all. Relative to existing policies which distribute aid through the commercial market they will experience a direct decline in real income because the price depressing effects will be eliminated. To argue that they should be compensated for their loss resulting from a change in the current program is to argue that they should be subsidized to consume food. In which case, they should be shifted from the group of buyers in the commercial market to the group of buyers in the concessional market. These consumers may experience indirect effects when their neighbors who buy in the concessional market improve their welfare.

Such a program completely eliminates the undesirable international trade effects and the negative effects on the recipient's commercial market, the two important criticisms of commodity aid per se. Compared to the other imperfect programs which only alleviate as many of the negative effects as each potentially can, this new means of demand expansion provides a relatively simple, potentially self-financing program which can be used as a policy instrument to better attain the

objectives of commodity aid. The valuation of the aid is also improved because its major costs are taken into account.

The best illustration of the establishment of a successful differentiated market scheme is the fair price shop system in India. Earlier, reference was made to its quite successful accomplishments of limiting the negative effects of aid. Several reasons have been offered for this success. Srivastava shows that the geographical distribution of the use of fair price shops is important because food aid is largely distributed in areas substantially differentiated from the large production areas (60, p. 144). In addition, the timing of the aid corresponds somewhat with production. "In India, the easy availability of cereals under P.L. 480 has made the fair price shops appear to be more a relief than a marketing agency" (60, p. 144). If the producers know that P.L. 480 aid is to be so used, the depression of prices caused by the aid upon the producers' decisions may be less than if the quantity of aid received annually were fixed.

However, much of the success of the Indian fair price shops rests on a very adept use of them which has not previously been recognized. Of all the wheat and rice issued through the fair price shops between 1957 and 1965 inclusive, 20 percent was procured internally (55, p. 78). That is, the Indian government procured supplies in its domestic market and distributed them through the concessional market along with imports, most of which were aid commodities. In addition, several commodities (wheat, rice and coarse grains) were distributed through the fair price shops (55, p. 78) so their program somewhat employed the concept of the aid composite good.

If this fact is combined with the results of Rogers which were given earlier, the analysis above shows the importance of procuring part of the quantity flowing through the concessional market from the commercial market. Recall that Rogers shows that the Indian scheme resulted in an expansion of (cereal) demand equal to 93 percent of the (cereal) aid, i.e., only 7 percent of the aid supply displaced commercial supply. "The new equilibrium price was reduced by 0.1314 units on a price index with a mean 89.12, or less than two-tenths of 1 percent" (56, p. 134). Note that these changes in the supply and price may partially reflect a shift to the left in the supply curve because of resource reallocation resulting from expanded demands for other commodities. Now let F be the quantity of food aid. Since the Indians procured 20 percent of the issue of wheat and rice (cereals) in the domestic market, the quantity flowing through the concessional market was 1.25F. Rogers' results imply that the total (concessional plus commercial) demand expanded by .93F. Since r is the ratio of demand displacement to the flow through the concessional market, 1 - r is the ratio of demand expansion to the flow through the concessional market. Then for the case of India, 1 - r is the ratio of .93F to 1.25F or 0.744. Hence the value of r is 0.256.

But wait! Above it was stated that Rogers' study implies the value of r is .07. Why the contradiction? The contradiction arises from the fact that the value for r of .07 is based on the assumption that only commodity aid was distributed through the concessional market. As shown by the data, that assumption is not realistic. Rogers limited the quantity distributed through the fair price shops to the quantity of the

aid because it was "the primary source of commodities for distribution through the fair price shops" (56, p. 124). Consequently his model is somewhat misspecified. However, for the purpose of illustration, it is assumed that his empirical results are correct. Because 20 percent of the distribution through the fair price shops was produced in the domestic market, Rogers' study actually implies that r equals 0.256.

If the Indians wished to completely eliminate the effects of aid, that is expand total demand by F, the above analysis and the value 0.256 for r implies that .358F rather than .25F should have been purchased in the domestic market and distributed in the fair price shops. That is, 26.4 percent rather than 20 percent of the total flow through the fair price shops would need to be domestic procurements. Had the Indians not issued any domestically procured cereal in the fair price shops, Rogers' study would have shown that 25.6 percent rather than 7 percent of the food aid displaced an equivalent quantity in the commercial market.

This change in the interpretation of Rogers' conclusion requires a reinterpretation of the costs of the demand expansion program. Since 1.25F was distributed through the fair price shops at a price of 50 percent to 100 percent of the commercial market price, the cost excluding administration, was between zero and 12.5 percent of the aid when valued at the recipient's commercial price. If the necessary 1.36F to maintain the commercial price was distributed through the concessional market, the cost, excluding administration, would be between zero and 18 percent of the aid when valued at the recipient's commercial price.

While Rogers' conclusion (that demand expansion through a differentiated market is a means of eliminating the negative effects of commodity aid) is right as far as it goes, it needs a big qualification. The qualification is that much of the success of such a scheme is contingent upon procuring an appropriate level of the aid commodity from the commercial market and distributing it along with the aid through the concessional market.

The assumption that there is no resource allocation away from the production of the aid commodity can be dropped. This again means that to maintain the commercial price at the level which would prevail without aid, it may be unnecessary to expand total demand by F. Again let X be the ratio of the decrease in commercial supply resulting from resource reallocation to the quantity of aid. Then the decline in supply is incorporated into the above analysis by substituting (1 - X)F for F in the above expressions. The greater the resource reallocation the larger X and hence the smaller the quantity which must be purchased in the commercial market and distributed through the concessional market. Clearly the less transferred from the commercial to the concessional market the smaller the cost of the program.

In summary, the only policy which is likely to be successful in eliminating the negative effects of the aid is a differentiated market with a mechanism of transferring some of the commercial supply to it. The chances of success of the other policies improves if there is a resource reallocation resulting in a decline in the commercial supply. This is the reallocation which occurs even when the aid commodity's price is maintained at the level which would prevail without aid.

However, the costs of the new demand expansion program with a differentiated market also fall when the commercial supply declines. Consequently, it is the most efficient policy of those considered to eliminate the losses resulting from aid.

The one limitation to the new demand expansion policy is the quantity of aid relative to the commodity's commercial supply. The latter may be so small relative to the former that even when all the commercial supply is distributed through the concessional market, the total demand is insufficiently expanded. Also, the quantity of the aid may be so large relative to the commercial market that the cost of the program would not be self-financing. But if the program is efficiently administered these do not imply it is a bad program, rather they imply the aid is a burden and its quantity should be decreased. In contrast, the alternative policies are unlikely to eliminate the losses regardless of how small the quantity of aid. Consequently, this new approach to demand expansion has both the advantage of greater efficiency in eliminating the losses caused by aid and the advantage of a better decision on the amount of aid.

A note referring back to Chapter IV is appropriate. If the scheme of a differentiated market is used to expand demand, the level of the expansion must be included in the input-output analysis. Only the excess of aid over the expansion will then substitute for commercial market transactions.

Monetary Impacts of Commodity Aid

So far the monetary effects of commodity aid have not been included in the discussion except for a brief review in the introduction. Recall the commodity aid literature and the international trade and finance literature a priori conclude the monetary effects of aid are neutral and indeterminate respectively when the income redistribution and timing problems are ignored. Before reaching a conclusion in agreement with the international trade literature, the arguments of the previous commodity aid studies are reexamined. A new analysis which emphasizes commodity aid is presented to theoretically determine its monetary impacts.

There have been two basic approaches for arguing that the effects of aid are neutral. One approach is represented by Elrod (19) and the other by Khusro (54). The arguments fail on the same point; that by spending the sale proceeds of the aid, the government precisely offsets the previous deflationary effects of taking money from the private sector when it sells the aid to the private sector. Below this point is shown to be incorrect.

In developing the analysis to show the monetary impacts of aid, Khusro defines a general price level, P, and analyzes it (54, p. 16). This level is the ratio of total expenditures to the total available supply of goods and services. It is given by equation 5.12 where C_p and C_g are respectively private and public consumption expenditures, I_p and I_g are respectively private and government investment expenditures, O is domestic output, X is exports and M is imports. Khusro's argument is that in a dynamic economy, the numerator and denominator of equation

$$(5.12) \qquad P = \frac{C_p + C_g + I_p + I_g}{O - X + M}$$

5.12 have been rising at the same rate, i.e., P is constant. When P.L. 480 grain arrives in the market, M rises and the price of grain would fall, other things equal. But it must be noted that the sale proceeds of the given imports accrue to government coffers when in turn they are spent on various projects.

> This additional expenditure on projects of an amount equal to the value of grain raises the price level once again and puts it back at a level where it was before the injection of P.L. 480 grain (54, p. 16).

Khusro also provides an explanation of how P.L. 480 imports may be analyzed by the quantity theory, equation 5.13, where O is domestic

$$(5.13) \qquad MV = PO$$

output, P the general price level, M the money stock, and V the income velocity of money. He states:

> The only way a change through imports and exports can be shown in the Quantity theory equation is by showing a decrease in M on the left-hand side of the equation arising from a balance of payments deficit or an increase in M through a balance of payments surplus. To that extent, on the right-hand side, the price level will fall or rise equivalently. However, since P.L. 480 transactions have no bearing at all on the net foreign exchange reserves, no change in M can be shown and consequently no change in P occurs. If imports were by Government, and were sold to public, a decrease in M can occur, if Government were to use the sale proceeds to run a budget surplus; if the sale proceeds were spent, there could be a budgetary balance once again and no change in M. On this latter, perhaps realistic assumption, there is no change in M. Thus, the conclusion would be that P.L. 480 transactions are non-inflationary even as they are non-deflationary (54, p. 16).

Khusro's quantity theory argument is unacceptable on two points. First, it implies that since M is constant, P cannot change. This need not be so for V or O may change, while assuming O is constant no proof is given for the lack of an impact of aid on V. Second, it holds that the supply of money is likely to change with an imbalance in the budget or balance of payments. This seems to confuse the money supply with the budget and balance of payments.

The approach by Elrod does not rely on changes in the real goods available in the economy as does that of Khusro. Elrod explains:

> To the extent that the United States or the recipient government withholds local currency receipts, the effect of the program continues deflationary. When funds return to the transactions stream of the economy the effect is inflationary, but the net effect, over the entire time period, is neutral assuming that the funds returned to the stream are equivalent in amount and impact to the funds withdrawn (19, p. 8).

Lachman employs a similar argument in his monograph on counterpart funds (38, p. 14).

So far the effects of putting the government rather than the private sector in control of the expenditure of the counterpart funds has been ignored. The importance of recognizing this change is made by first Elrod and then Lachman below:

> If government expenditure results in a higher multiplier than a private expenditure of equal amount, the effect is inflationary; if in a lower multiplier, deflationary (19, p. 8).

> To say as the critics do, that this purchasing power is not a real resource is perfectly true, but to leave it at that, as the critics also do, is the same as closing ones eyes to the effects of redistributing income, or as denying any significance to fiscal policy. The fact is that programme aid transfers money from the population to the government, exactly as taxes do, except

> that it is politically and economically an absolutely painless process (38, p. 8).

Counterpart funds are owned by either the recipient's or the donor's government. In fact the recognition of a potential shift would be required even if the commodity aid were transferred through private accounts. None of the arguments make any distinction as to whether or not the aid is a grant or loan. This is appropriate for the moment because the intent of the argument is to abstract from the difference between loans and grants. Also note that the arguments for neutrality require the proceeds from the sale of the aid be spent in the same period the aid is sold.

Before going further with the analysis of aid, it will be useful to step back and start fresh with a more thorough consideration of monetary conditions. This will provide a better base upon which to discuss the monetary effects of aid. There are three possible monetary conditions: inflation, stability, and deflation. A stable condition is the lack of inflation or deflation and deflation is the logical inverse of inflation. By defining inflation, definitions are also implied for the other two.

The cause of inflation is a greater monetary demand than can be satisfied by the limits of the available real resources (68, p. 1). A standard definition of inflation is a rise in the general price level. However, there are both statistical and conceptual problems with such an approach. Bronfenbrenner and Holzman list nine such problems (7, pp. 50-51). Among them are these questions. Which price level should be used? Has its change been anticipated? Is it permanent and

irreversible? Should black market and controlled prices be included? The other problems of defining inflation are associated with the dynamics of an economy. They include shifts in consumption habits, changes in the set of products supplied both in terms of quality and new entries or removals from the market, a disastrous destruction of the supply, and changes in production cost because of technological change.

Depending upon how each of these problems are handled, various definitions of inflation can be established. Bronfenbrenner and Holzman cite Turvey's definition as being the most comprehensive; it is:

> The process resulting from competition in attempting to maintain total real income, total real expenditure, and/or total output at a level which has become physically impossible, or attempting to increase any of them to a level which is physically impossible (7, p. 52).

The limitation of this definition, however, is that it does not imply an obvious means of quantitative measurement. A final approach to defining inflation is given because it is an approach which can be associated with some of the theory of international transfers.

> Inflation is a fall in the external value of money as measured by foreign exchange rates, by the price of gold, or indicated by excess demand for gold or foreign exchange at official rates (7, p. 52).

This abridged review of inflation indicates the severe problem of isolating the monetary effects of commodity aid. The very existence of commodity aid causes a change in the real resources available which is contrary to most comparative static analyses of inflation. The more usual procedure parallels the Keynesian analysis and fixes supplies. To obtain greater insight into the circumstances surrounding commodity aid, a hypothetical situation is constructed which permits the isolation

of the effects of aid. After the hypothetical situation is developed, its assumptions will be relaxed to approach the real world.

The hypothetical situation is an exchange economy that, except for the aid, is isolated. Assume all transactions are done without cost. Also assume there is a government and a collection of consumers each of which has a bundle of goods as an endowment. Assume there is an equilibrium in the exchange economy prior to the introduction of aid. The government receives a quantity of commodity i as aid. It is homogeneous with commodity i with which some of the consumers are endowed. The government sells the aid to the consumers. Assume that there are two mutually exclusive consumer groups: the sellers and buyers of commodity i. The sellers have an initial endowment of commodity i but do not consume any of it and hence sell their entire endowment. The buyers do not have an initial endowment but purchase it for consumption from either or both the government or the sellers. There may be a third group of consumers which neither buys nor sells commodity i. One of the commodities in the bundle of goods held as an endowment is money. It is assumed that the money supply is fixed. At the same time the government sells the aid, it accrues the sale proceeds of the aid which are called counterpart funds. As the aid is sold by the government, exchange of all commodities is permitted to allow the economy to reach a new equilibrium.

The consumers who purchase the aid could buy it with their money holdings at the price it was in the economy prior to the aid. This would expand the government coffers. However, this is unlikely to occur for two reasons. First, it requires an infinite price elasticity of

demand for commodity i. As was argued earlier in this chapter, this is most unlikely. Second, it requires the rate of substitution between money and commodity i remain constant over the range of the increased supply of commodity i. Economic theory also argues this is unlikely since it requires a very special preference function. Certainly these conditions do not hold a priori. More likely the price of commodity i will fall.

Momentarily assume that the nominal money holdings of consumers is constant. As a result of the above experiment, it will be shown that the price of all commodities in the economy cannot be maintained while the money holdings of the consumers remain constant. Assume that the price elasticity of demand of commodity i is uniformly one. Then the total expenditure for commodity i does not change but the government receives that part of the total expenditure which corresponds to the quantity of aid, W, and the holders of the domestic supply of commodity i will experience a revenue loss also equal to W, because of the uniform unit elasticity of demand.

Providing preferences remain constant, that is if the government spends W for identically the same bundle of goods which the losers of W would have purchased had they not lost the revenue, the expenditure for each commodity other than commodity i will remain constant. Also, all prices other than that of commodity i will be constant. Given an exchange economy the supplies of all but commodity i are fixed and this in conjunction with constant expenditures for these commodities implies constant prices. But even after the government has spent W, the price of commodity i has declined. Only if the government bought

a quantity of commodity i equal to that of the aid would there be no price effects. But then the whole process would be circular and the experiment would be right back where it started with the commodity aid in government inventories.

At this juncture, the monetary effects of the aid appear to be deflationary due to a decrease in the price level caused by the decline of the price of commodity i. However, there are other factors to be considered. The level of real incomes of the sellers and buyers of commodity i have changed. The real balances of consumers have changed, the money incomes of the sellers of commodity i have fallen by W and the government budget increased by W.

So far nothing has accounted for the changes in real incomes and real balances. Consider first the sellers of commodity i. Their loss in real income, y_s', is shown by equation 5.14

$$(5.14) \qquad y_s' = \frac{Y_{so} - W}{P_{so}} - \frac{Y_{so}}{P_{so}}$$

where Y_{so} is the original nominal income of the sellers of commodity i and P_{so} is the original price index of the commodities purchased by the sellers. The same price deflator is used for before and after aid because the sellers do not consume any of commodity i and its price is the only one which changes. Another approach would be to use the index of all prices as the deflator.

The real balances of the sellers can be interpreted in two ways depending on the price level one chooses for a deflator in the after aid case. Again with a constant deflator, the real balances are constant,

given the assumption of constant nominal money holdings. With the index of all prices as the deflator, their real balances have increased. The sellers' demand for real balances is an empirical question, but it is likely to decline because of the fall in their real incomes. At the same time their supplies of real balances, depending on the choice of the price deflator, were constant or increased. Hence, they will likely have excess supplies of nominal money and try to reduce them by spending some of it for other goods.

The increase in real incomes of the buyers is given by y_b' in equation 5.15 where Y_{bo} is the original money income of buyers and

$$(5.15) \qquad y_b' = \frac{Y_{bo}}{P_{b1}} - \frac{Y_{bo}}{P_{bo}}$$

P_{bo} and P_{b1} are the price levels of the goods consumed by the buyers of commodity i before and after aid respectively. The money incomes of the buyers is unchanged because as was shown above the supplies and prices of the commodities with which they are endowed are constant. Since the price of commodity i declines, P_{b1} is less than P_{bo} and y_b' is positive.

Under the assumption of constant money holdings, the real balances of the buyers have risen because of a decline in the price level. Thus, the buyers' supplies of real balances rise at the same time their real incomes rise. The relationship between the two shifts is an empirical question. There is no a priori reason why these shifts in the supply and demand of real balances will be equal. Their real incomes and real balances are both effected solely by the change in the price level

and hence will change by the same proportion. Only if the elasticity of real balances with respect to real income is unity will the two shifts offset each other. If this elasticity is less (greater) than one, the buyers will try to decrease (increase) their nominal holdings of money.

Putting the effects on the two groups together, if money is a normal, but not a luxury good, the sellers and buyers will try to decrease their nominal holdings of money. If it is an inferior good, the sellers and buyers will try to increase and decrease respectively their holdings of it. If it is a luxury good, the sellers and buyers will try to decrease and increase respectively their holdings of it. Of course, it need not be the same type of good for all consumers. Its' elasticity with respect to real income is an empirical question. If the consumers as a group try to decrease (increase) their nominal money holdings, prices will be forced upward (downward). Only if they bid the prices up precisely enough to offset the decline in the price of commodity i can the aid be neutral. Hence whether or not aid is neutral is an empirical question and its monetary effects cannot be shown to be neutral a priori.

The interest rate may be an alternative means of adjustment when aid enters an economy. If the aid results in an excess demand or supply of nominal money holdings, the interest rate may rise or fall respectively to bring the demand for money into equilibrium with its supply. But keeping the real rate of interest constant, a rise in the nominal interest rate implies a rise in the price level. Thus, a change in

the nominal interest rate may be transformed into a price change to determine if the change is inflationary, neutral, or deflationary.

The reception of aid results in an increase in real resources and may cause a change in the price level. There is no agreement that a general price increase is inflationary if real output rises (7, p. 51). Therefore, neither can it be said that there is agreement that a price decline in the face of increased supplies is deflationary.

Now the assumptions made in the hypothetical situation must be relaxed; however, their relaxation will not effect the conclusion. It was assumed that the government would purchase the same goods with W which would have been purchased if there had not been aid. This merely assumed away the fiscal effects of income redistribution which were discussed above. If this assumption was not made, price changes and hence income changes other than those directly associated with the increase of commodity i would have to be considered. The empirical conditions required to result in neutral effects would be more complex.

The assumption that the price elasticity of the demand for commodity i is uniformly one also eliminates some of the effects of income redistribution. If it were not uniformly one, the consumers of commodity i would spend either more or less for other commodities when aid is introduced. The identification of price changes and the resulting income effects would be more difficult, even with constant money holdings. Neither could the purchases by the government with W exactly offset the loss of W by those consumers initially endowed with commodity i. If this assumption were not made, others could be used to replace it.

For example, if the price elasticity were less than one, the buyers would have more to spend on other goods. This could be assumed to exactly offset the increased loss of purchases by the sellers.

Recall that the groups of consumers initially endowed with commodity i and those which ultimately purchase it for consumption were assumed to be mutually exclusive simply to avoid discussing the effects of a price change on a commodity which a consumer held as an initial endowment and either sold in part or acquired more of it. The assumption makes no difference upon the final conclusion but facilitates the simplicity of the argument by associating particular effects with certain consumer groups. If the assumption were not made, then it would be possible to divide the consumers into more groups. For example, one group could be those who had an endowment of commodity i, consumed it all, and bought no more. Increasing the number of groups would only increase the complexity of the argument.

The assumption that there is a commodity in the economy identical to that received as aid eliminates the need to consider a change in the commodity set of the economy. If this assumption were dropped so that the commodity received as aid was not previously available in the economy, the argument would need to be changed somewhat. For then there would be no group of consumers corresponding to the sellers. Those who would buy the aid would have to reduce their expenditures on other goods. This reduction could be precisely offset by the disbursement of the counterpart funds received by the government. But then it would be more difficult to show the effect on real incomes

and to define the changes in the price level. The prices of all commodities originally in the economy could be held constant through the disbursement of the counterpart funds. But there would be a new price for the aid commodity which in a sense did not exist prior to the aid. For one reason or another, i.e., government controls or the relation between production costs and effective demand, the equilibrium quantity of the aid was originally zero. This may be interpreted that the price was too high for any effective demand. In that case, the implication would be that its price, and hence the general price level, would have fallen.

If such an argument of a fall in the price level is unacceptable, there is another approach to argue that there would have been an effect on real incomes. Relying upon the theory of revealed preferences, it could be argued that the buyers of the aid commodity either would have constant or increased real incomes because they preferred to buy the aid commodity. Only a unique preference function would hold if their real incomes were constant, so it is empirically probable that their real incomes would have risen. Once this point is established, even if prices were interpreted to be constant, an argument incorporating the demand for nominal money balances could be made to show there is no a priori reason to expect that the monetary impact of aid would be neutral.

The economy was limited to an exchange economy to avoid the need to discuss production and changes in supplies other than the commodity aid. Introducing production would permit the effects of aid to be channeled through both supply and demand. For example, because of

a decline in the price of commodity i, its production would likely decrease and that of other commodities increase. This would be the case of aid substituting for domestic production. Eliminating this assumption would complicate following the redistribution of income effects in the argument, but would not change the results.

The possibility of international trade was excluded. The inclusion of international trade would permit a shift in demand between domestic and foreign goods due to the change in real incomes and wealth. However, in order to again attain equilibrium, it may be necessary for changes to occur in the rate of exchange. One of the results of eliminating this assumption would be that the level of commercial imports of the aid commodity may fall as aid substitutes for imports. The possibility of international trade does not change the conclusion. In fact, as was seen in the introduction, it is supported by the transfer problem of aid as discussed in international trade theory.

As reviewed above, one method of defining inflation was a fall in the external value of money and hence as a fall in the exchange rate defined as the value of a unit of foreign currency expressed in domestic currency. The exchange rate used in defining inflation and the terms of trade used by Vanek are not the same. However, they are closely related and a change in the exchange rage can be related to the terms of trade with the price elasticities of the supply and demand schedules of imports and exports (67, pp. 78-79). Since the effect of the transfer on the terms of trade and the effects of the terms of trade on the exchange rate are both empirical questions, the

monetary effect of the transfer is also an empirical question. Thus, the theory of international trade supports the conclusion reached above.

Finally, the assumption that all transactions are costless permits the usual type of demand and supply curves. The introduction of transaction costs could be accomplished by introducing changes in the supply and demand curves. The money supply and money holdings are assumed constant in order to isolate the effects of aid from these changes. Similarly, an initial equilibrium is assumed to avoid accounting for the difference between an initial position and an initial equilibrium position.

In summary, the conclusion reached is that the monetary effects of aid, ignoring the problems of the accrual over time of counterpart funds and income redistribution, cannot for any a priori reasons be shown to be neutral as was previously argued. The reason that it has not been able to show that aid is neutral is because the effects of aid are not precisely offset by the government's expenditure of the counterpart funds. The effects of the aid upon real income and real balances have been taken into account as they should be before reaching any conclusion. The inclusion of these effects shows that the spending of the sale proceeds of the aid by the government does not necessarily offset the previous deflationary effects of taking money from the private sector. Also, the possibility of a change in the amount of nominal money demanded implies, given a fixed nominal money supply, that V will potentially change. This permits the conclusion reached with the quantity equation to concur with the one drawn here.

The previous implications of the aid literature were that monetary impacts of counterpart funds were neutral if the counterpart funds were spent in the same period in which they were generated. It has been shown that this is a false conclusion. However, it must be added that the monetary impacts will be different if the counterpart funds are unspent and accumulate over time. Empirically the monetary effects of accumulating the funds, assuming the money supply is held constant, is deflationary because it is a case of government hoarding. However, if the accumulated funds are held in bank accounts which are a basis of the money supply, the ultimate effect may again be hard to determine. If the government hoards the counterpart funds, then its direct deflationary impacts are not likely to be reversed or offset by the indirect real income and real balance effects because the latter are probably relatively small, especially in countries with a minimally developed monetary system.

Other than recognizing the monetary impacts of commodity aid, there is little which can be said without a complete discussion of monetary policy. The monetary authorities must take account of the direction and size of the aid impacts so that the goals of their policies to attain a desired situation are not upset. Finally, the monetary effects described in this section may cause additional shifts in the demand and supply curves discussed in the previous sections of this chapter.

CHAPTER VI. STRUCTURAL CHANGE

Causes of Structural Change

There are three major reasons for including a chapter on structural change. First, the impact of aid changes when there are structural changes. Second, one of the most critical arguments against input-output analysis is that it is based on a fixed structure. Third, the structure of the economy may be changed by design in order to investigate the implications of its change.

The structure of an economy represented by a static input-output table is the A matrix of Chapter II, the input coefficients matrix. A change in the structure is therefore a change in the A matrix (41, p. 19). The interest in dynamics and the desire to overcome the criticism of fixed input coefficients has led to the development of dynamic input-output analysis. It considers changes in capital and hence investment directly. However, by so doing it also requires a greater quantity of information to formulate the capital coefficients. The gathering and collection of capital coefficients is more difficult than the flow matrix and hence they are generally not available for less developed countries. Associated with the scarcity of capital coefficients is the lack of their empirical use and indication of their reliability. Consequently, the dynamic models are not pursued here but rather the simpler first cousin of dynamics, structural change, is. The relationship between dynamics and structural change is expressed well by Leontief.

> Within the framework of an explicitly formulated theoretical system, economic change can be explained either as structural change or as a dynamic process. In the first case, the variation of the dependent variables is simply related to the underlying changes in some of the basic data; in the second, the law of change itself is considered as given, i.e., built into the structure of the explanatory scheme (41, p. 17).

Given that a structural change is a change in the basic data, the model is, of course, unable to provide any explanation of the cause of the change (41, p. 20). Like the changes in the final demand sectors, the qualitative and quantitative characteristics of a structural change must be generated from without the model. Once the structural change has been determined, it can be incorporated into the model to show the effects upon total output or final demand, whichever is taken to be endogenous, and primary inputs. There are two motivations which may arise for determining a structural change. The first is to update the input coefficients in an input-output table and the second is to consider the impact of potential investments or other causes of changes in the input coefficients.

Changes in input coefficients and hence structural change may occur for several reasons. These reasons may be divided into the following five classes: (1) scale of production changes, (2) technological changes, (3) preference changes, (4) price changes, (5) residual changes. These five reasons apply to an input-output model with a fixed sectoral classification. If the number or definition of sectors changes, it is obvious that the input coefficients will change.

Changes in the level of output of a sector may invalidate the input coefficients because the model is based on the assumption of a

direct proportionality of inputs and outputs. When this assumption is contrary to fact, the changes in the level of output of a sector require changes in its input coefficients.

Technological changes obviously effect the input coefficients. This is implied by the very definition of technology, the relation of inputs to output. There are different ways of defining technological change.[1] There may be technological changes which do not effect the A matrix, such as changes in primary input requirements. But clearly any change in technology, whether it results from investment or whatever, which changes the proportional relationship between the output and inputs from the intermediate sectors will result in changes in the input coefficients. Technological changes may result in either the substitution of one input for another or a proportional change in all inputs.

Preference changes could be considered to be of two types. First is an overall change in demand with an identical proportional change for each product. This could effect the input coefficients through changes in the scale of production described above. The second type of preference change is a shift in relative preferences. This may result in not only changes in scale of production of individual sectors, but also in changes in preferences for the products classified between sectors and within a given sector. Preference changes between sectors alter the product mix of a sector through intermediate demand whereas

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[1]For a statement of the concept see 8, pp. 1-28; and for models used to measure it see 39, pp. 7-21.

preference changes within a sector alter the product mix directly through final demand. The input coefficients will change when the product mix of a sector changes, unless each product of the sector is produced by an identical combination of inputs. Such a change in product mix is an aggregation problem.

Price changes cannot be considered as changes in basic economic data because they are the result of changes in supply and demand. Prices provide the link between production and consumption. The input-output model does not have a mechanism incorporating price changes. Consequently, price changes may have two separate effects. They may cause substitution in production and/or consumption. The changes in consumption will analytically have effects similar to those of preference changes. Likewise, the substitution effects in production may analytically be compared to substitution effects of technological changes. The cause for price changes must arise from changes in supply and demand. It would appear that changes in demand and supply have been included under preference and technology changes respectively and hence encompassed price effects. But the price effects must be included in order to link the exogenous final demand sectors and the intermediate production sectors together when there is a technological or preference change.

Finally, there may be residual changes in the input coefficients due to such effects as errors of observation, valuation, record keeping, etc. All of these residuals arise from inappropriate data rather than from methodological causes.

Sevaldson provides a similar, but somewhat different, list of reasons for differences in input coefficients. His list includes: (1) a trend factor, (2) the level of the input using sector, (3) a function of exogenous variables to the model, (4) a function of variables endogenous to the model, (5) errors of observation, and (6) a residual term (59, pp. 305-311). His reasons 3 and 4 are essentially concerned with price changes. He links the changes in product mix, without referring to them as preference changes, to changes in relative prices. He does not associate price changes with technological changes as was done above and considers technological change to be incorporated into the trend factor. Although Sevaldson considers all the causes discussed above, the underlying causes of the changes is not as clear as in the above list. His classification is based on the functional and statistical roles the variables play in the model.

The United Nations' publication on input-output methods considers only four reasons for changes in the input coefficients: (1) changes in prices, (2) changes in technology, (3) changes in the composition of sector output, and (4) non-linearity in the production function (66, p. 106). This classification is similar to the one above except that the statistical residual has not been included. What is described as preference changes above falls under changes in the composition of sector output.

Methods of Obtaining New Coefficients

The methods of estimating input coefficient changes depend on the the motivation for changing them and the information available. As stated

at the beginning of the chapter, two basic motivations for changing them are to update a table or to measure the impact of a possible change in the future. The significant difference in information is whether there is only one or several input-output tables available.

If the motivation is to make an older table more current and there is only one table available, the estimation of the change must come from outside the model. Such estimates may range in complexity from educated guesses by persons familiar with the sector whose relationship is being adjusted, to a thorough statistical analysis similar to that done to estimate the coefficients when a new table is being constructed. One intermediate possibility of this range is to sample some of the firms within the sector.[1]

If there is more than one table available, the estimated changes in the coefficients may become a statistical problem. Because of the constraints usually imposed on the coefficients by the model, Briggs has shown that least squares is not generally an efficient procedure (6). The relation between the intersectoral flow of inputs from sector i to j and the level of output of sector j may be written as equation 6.1.

$$(6.1) \qquad Q_{ij} = A_{ij}q_j$$

Given several observations, an error term may be added to the equation and statistical estimation applied to it. Briggs shows that only if q_j

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[1] Miernyk uses this approach to project coefficients by concentrating the analysis upon high productivity firms (46, pp. 118-121). Other approaches may be found in Problems of Input-Output Tables and Analysis (66, pp. 105-110).

is fixed can least squares be employed. If q_j is also considered to be a random variable, then the model should be used only in the open form and methods of maximum likelihood used (5, 6).

When the motivation for changing the coefficients is to analyze the impacts of future changes, such as technology, the use of past trends may not be appropriate. The changes must then be estimated by the best means with the least cost which is deemed satisfactory for the problem at hand. One possible source of information is to compare the input-output tables of countries at successive stages of development.

Given that there are many methods to employ in changing coefficients, it would be useful to know how often coefficients ought to be updated. Fox and Thorbecke formulated the answer in terms of costs and benefits. Their analysis is in conjunction with policy models, i.e., models which indicate normative results given a welfare function.

> The revision of the input-output coefficients should be undertaken when the loss of welfare (measured in a 'policy output' sense, i.e., lower levels for the stabilization goals, ...and greater uncertainty of attaining these targets because of higher variance) for a given set of instruments is equal to the cost of preparing a new set of estimates for the a_{ij}'s (28, p. 52).

In terms of updating coefficients for a policy model of the Netherlands, they conclude that the coefficients should be re-estimated every three years (28, p. 56).

Once the new coefficients have been estimated, the input-output model can be used for any of its standard applications as well as the analysis of aid provided in Chapter IV above. When the effects of changes in the coefficients resulting from changes in technology, scale,

prices, or preferences are estimated, the results of the model with and without the changes can be compared. The new (I - A) matrix, resulting after the change, can be calculated and used in the same fashion as the original (I - A) matrix.[1]

The Implications of a Technological Change

In the next chapter, the utilization of fertilizers for foodgrains production in India is changed to illustrate structural change empirically. This change is associated with the technological change of new high yielding varieties, especially for wheat. The five causes of structural change given in the previous section may not occur independently. This structural change may be described as a technological change because the fertilizer input coefficient for foodgrains has changed largely in response to new grain varieties.

Technological change is an important part of economic development. The so-called "green revolution" is a vivid illustration of technological change. The improved seeds, especially wheat, along with increased fertilization, irrigation, and plant protection have provided a new stimulus to the hopes of transforming traditional agricultures. Punjab in India provides a striking example of the change.

Farm management studies were conducted in Punjab in 1955-56 for the districts of Amritsar and Ferozepur and again for Ferozepur in

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[1] Moore provides a means of calculating the effects, resulting from changes in coefficients of a column in the A matrix, upon the output of a given sector without inverting the entire matrix of new coefficients (48, p. 232).

1969-70 (14, 15). The two districts are very similar and largely wheat producing areas so the 1955-56 and 1969-70 studies can be compared. Data for Amritsar and Ferozepur are given separately for part of the 1955-56 study. But since some of it is not and the districts are very similar, the data for the combined districts for 1955-56 can be compared to that of Ferozepur for 1969-70 without any significant consequences.

Table VI-1 shows the percentage breakdown of total cost and yield per hectar of wheat in Punjab based upon the farm management studies. The 1955-56 data is based on a weighted average of irrigated and unirrigated wheat. The 1969-70 data is based on a weighted average of Mexican and Desi wheat. The weights in each case were relative areas of production. It shows that total cost and yield have risen by 464 percent and 243 percent respectively. This implies that inputs have risen more than output but output is in real terms and costs in value terms. If output is adjusted for the increase in wheat price, the increase in output rises to 442 percent which is a much smaller decline in the ratio of revenue to cost. The change in wheat price was derived from the Bulletin on Food Statistics (12, p. 151; 13, p. 222).

However, rather than adjusting for the price of wheat it is more useful for the purpose of showing technological changes to deflate the costs of the various inputs. Fortunately the studies themselves give information on physical inputs of human and bullock labor which permits deflating the 1969-70 values with the 1955-56 prices. These deflated components of cost are given in column 3 of Table VI-1. The quantity of seed input is not given so the value of seed inputs for 1969-70 has been deflated by the wholesale price index for wheat as given in

Table VI-1. Production and components of total cost of wheat production per hectare in Punjab

	1955-56[b] (%)	1969-70[c] (%)	1969-70 in 1955 prices (%)	Ratio[a] 1969-70 to 1955-56	Ratio[d] deflated 1969-70 to 1955-56
Human labor	25.7	25.6	16.7	4.62	1.05
Bullock labor	24.5	10.1	3.4	1.91	.23
Seed	6.5	3.9	6.0	2.78	1.49
Manure & fertilizer	1.5	9.7	20.2	30.80	22.33
Insecticides & pesticides	.0	.1	.2[d]	unde-fined	unde-fined
Machinery, buildings, implements & interest on fixed capital	4.6	11.7	21.0	11.89	7.43
Irrigation	3.0	4.8	8.6	7.32	4.58
Taxes, interest on working capital & miscellaneous	2.7	1.6	4.5[d]	2.69	2.69[d]
Rent	31.5	32.5	19.4	4.80	1.00
Total (rupees)	100.0 341	100.0 1583	100.0 553	4.64	1.62
Yield (kgs)	942	2292	2292	2.43	2.43

[a]Ratio of actual, not percentage of total cost, of the two studies.

[b]Source: (15, pp. 104, 114, 124).

[c]Source: (14, pp. 130, 145, 165).

[d]Not deflated, still in 1969-70 prices.

the Bulletin on Food Statistics (12, p. 151; 13, p. 222). The deflator for fertilizer was derived from wholesale price indices from the Economic Survey of Indian Agriculture (18, pp. 143, 153). However, the data only included up to the year 1968 so that year was used as a proxy for 1969-70. Although it is only a proxy for the proper price index, the wholesale price index for iron and steel manufactures was used to deflate the 1969-70 costs of both the component comprised of machinery, buildings, implements and interest on fixed capital, and the irrigation component. The iron and steel manufactures wholesale price index was taken from the Economic Survey (16, p. 108; 17, pp. 125-126). No price indices are available which can be readily applied to either the component of insecticides and pesticides[1] nor that of taxes, interest on working capital, and miscellaneous. However, both of these components constitute a very small part of total cost in both 1955-56 and 1969-70. No index is needed for rent because the data has been calculated on the basis of a hectar for both times of observation.

A comparison of columns 1 and 3 of Table VI-1 shows the structural changes of inputs for wheat in Punjab. It shows there has been a decline in the importance of the human labor, bullock labor, seed, and land and an increase in the importance of fertilizer--machinery, buildings, implements, and interest on fixed capital--and irrigation. Because of the lack of an adequate price deflator it is not clear how the importance of the component consisting of taxes, interest on working

[1]Chemicals could have been used, but the chemicals of interest compose a very small fraction of the total index.

capital, and miscellaneous has changed. Even though insecticides and pesticides are not deflated, its importance has likely increased as a part of the package of seed, fertilizer, and plant protection. This change in input structure shows that the sum of the inputs--manure and fertilizer, machinery, implements, buildings, interest on fixed capital, and irrigation--have increased from 9 percent to 50 percent of all inputs between 1955-56 and 1969-70. It seems unlikely that manure and interest on fixed capital accounted for much of this change. Hence, most of these inputs which have increased in importance are likely to be purchased inputs. This shows that there has been a marked increase in the flow of real goods from the non-agricultural sectors to wheat production in the Punjab. These changes are shown in column 5 of Table VI-1 where the proportional change in real inputs is given. It shows those inputs which are likely to be purchased from other sectors have substantially increased. In fact, it shows that the absolute level of all inputs per hectare, except bullock labor, has increased. The marked decline in bullock labor probably arises from both a displacement in cultivation and irrigation power.

The contrast between the changes in value and real input shares is striking. Although land and human labor decreased in their real input shares, a comparison of columns 1 and 2 shows that their relative value shares have been approximately constant. In current values, bullock labor; seed; and taxes, interest on working capital, and miscellaneous are the only shares which experienced a relative decline. It is somewhat ironical to note that while the new Mexican varieties of seed have been a major stimulus for the technological changes (4, p. 24),

the relative share of seed in current values has declined. The explanation of the fall in the relative share for seed, while it appears to have an increased marginal physical product, may be that the increased supply of wheat along with its major proportion of demand arising from non-seed uses results in a relatively depressed price. In other words, the demand for seed is only a small part of the total demand.

The relative change in the value of inputs between 1955-56 and 1969-70 is shown by column 4 of Table VI-1. It shows an increase in the value of all components of inputs. This column again shows that manure and fertilizer, machinery, buildings, implements, and interest on fixed capital have substantially increased their relative proportion of total cost. Human labor and rent (land) have changes approximately proportional to the change in total cost. The shares for bullock labor; seed; and taxes, interest on working capital, and miscellaneous decline.

The data in Table VI-1 is only for wheat in the Amritsar and Ferozepur districts of Punjab. It shows the effect on inputs of one of the most dramatic changes in the "green revolution." Because of the high productivity of wheat in these districts, the data cannot be taken as typical for all of India nor for other crops. However, the implications of this change for others which could follow for rice, maize, and other crops over larger geographical areas of India are important. The point is not new but the data is a demonstration of the fact that as agricultural development occurs, its interdependence upon other sectors rises.

CHAPTER VII. ANALYSIS OF NEGATIVE IMPACTS OF AID IN INDIA

Scope of the Analysis

In this chapter the methods of input-output analysis are employed to empirically investigate the impacts of aid on the several sectors of the Indian economy. Only the negative impacts of aid transmitted through the sector associated with the aid commodity under the assumption of constant prices are derived. As shown in Chapter V, the determination of the net benefits of aid with flexible prices is much more complex than can be analyzed using input-output. The benefit of aid is the increase in income which results in greater demands. The estimated increases in demand of the several sectors would need to be included in the model if the benefit of aid were to be included. But these increases are not considered. Rather, the effects of aid derived are those assuming that the final demands of the several sectors are constant. This limited approach is taken because only the relative negative effects on the several sectors is considered. It was argued above that not all the demand increases will occur in the sector corresponding to the aid commodity. Given an input-output table, the relative effects of aid on the several sectors can be derived.

The analysis below shows how large the negative impacts on all sectors of the Indian economy would be if none of the increase in income were spent in the sector of the aid commodity. Admittedly, this is the extreme. Probably some or even most of the increase would be spent in the sector associated with the aid commodity and thereby reduce the effects. Historical levels of P.L. 480 aid to India are used for the

analysis. The actual negative effects transmitted through the sector associated with the aid commodity could be calculated by multiplying the effects of a unit of aid times the quantity of aid which substitutes for domestic production.

The analysis illustrates the use of gleaning information about the impacts of aid from readily available data. It illustrates some, not all, of the methods developed in Chapter IV.

Input-output Table for India

An input-output table prepared by Saluja for India is readily available (57). The table is for 1964-65 and hence is not as current as it could be for an ideal policy making situation. However, there has been a tradition of progressively improving the input-output tables for India and hence more recent ones are likely to be available soon. Previously, Indian tables were prepared for the years 1951-52, 1953-54, 1955-56, and 1959 (66, pp. 132, 136).

Although the table is somewhat dated for current analysis, it is most timely for the analysis of the historical impact of aid. This is because the last half of the 1960's was the peak of P.L. 480 aid to India. The empirical analysis will, with the exception of the section on fertilizer inputs into foodgrains, refer to the impact of aid on the Indian economy as it was structured in 1964-65. The table constructed by Saluja does not distinguish between P.L. 480 and other imports, so the level of aid must be derived from other sources. The analysis will consider the impact of a unit of aid and also the impact of aid at its average approximate level for the years 1964 to 1969. Three different

commodities; foodgrains, cotton, and vegetable oils, will be used to illustrate the techniques of Chapters IV and VI.

Saluja published his table in value flows and based the 1964-65 values on 1960-61 producers' prices. His table contains 77 inter-industry sectors, an unallocated sector, six sectors in final demand, and eight sectors of "primary" inputs. The six final demand sectors are household consumption, government consumption, exports, imports, gross capital formation, and change in stocks. The "primary" input sectors are consumable stores, repairs, work done by others, postage and stationery, non-industrial services, depreciation, margin, and value added. A 77 x 77 input-output table is quite large and relatively detailed. Since the analysis here is concentrated upon P.L. 480 imports the sectors which are of greatest interest are those which interact with the aid imports. Consequently, the 77 x 77 table is aggregated into a 39 x 39 table. The interindustry sectors aggregated and the justifications for the aggregations are given in Table VII-1. The motivation for aggregation is to reduce the size of the table without losing desirable information.

The principles of sector aggregation have been simply stated by Chenery and Clark (11, p. 36). They show that no errors of aggregation arise if (1) the sectors aggregated have identical input coefficients or (2) the outputs are demanded in fixed proportions. In most cases these conditions cannot be perfectly satisfied and the aggregation depends on the interest of particular sectors in the problem at hand. Although it may lead to errors, one reason for aggregation is simply a

Table VII-1. Aggregation of sectors

Sector in 77 x 77 table	Sector in 39 x 39 table	Justification[a]
1. Construction	1. Construction	2
8. Cement		
6. Iron & steel	6. Metals[b]	1
7. Iron ore		2
9. Non-ferrous metals		1
10. Other minerals	7. Minerals	3
22. Salt		
11. Rubber	8. Rubber	2
61. Rubber footwear		1
62. Tires & tubes		1
63. Other rubber products		1
12. Leather	9. Consumer products[c]	2
13. Other leather products		2
14. Leather footwear		2
26. Biscuits & confectionery		2
27. Cigarettes & cigars		2
28. Bidi		2
29. Other tobacco products		2
30. Fruits & vegetables preservation		2
31. Cashewnut processing		2
47. Tobacco		2

[a]The justifications for aggregation are (1) similar inputs, (2) output demands in fixed proportion, and (3) disinterest of individual sectors for current problems. Since conditions 1 and 2 never hold perfectly, there is an element of 3 in all of the aggregations.

[b]Actually 55 percent of the iron ore is exported, but it is aggregated with sectors 6 and 9 on the basis that its output will increase proportionally with those sectors.

[c]This is an aggregation of a hodgepodge of sectors of which each of the outputs flows to one of the other sectors in the group or to household final demand. The three exceptions are that 40 percent and 75 percent of sectors 12 and 31 respectively is exported and about 50 percent of sector 77 is consumed by the government final demand sector.

Table VII-1. (continued)

Sector in 77 x 77 table	Sector in 39 x 39 table	Justification[a]
48. Fruits & vegetables		2
55. China-ware & pottery		2
76. Matches		2
77. Printing & publishing		2
17. Sugar		1
19. Gur & khandsari	12. Sugar	1
46. Sugarcane		2
34. Cotton yarn 35. Cotton textiles	21. Cotton products	2
36. Jute 37. Jute textiles	22. Jute	2
38. Wollen yarn		2
39. Wollen textiles		2
40. Raw silk	23. Other textiles[d]	2
41. Silk textiles		2
43. Artificial silk fabrics		2
44. Other textiles		2
54. Timber		1
56. Wood (others)	31. Forest products	1
57. Other forest products		1
59. Petroleum products 60. Crude oil	33. Petroleum	2
65. Plastics		1
66. Dyestuffs		1
67. Paints & varnishes	35. Other chemicals	1
69. Drugs & pharmaceuticals		1
70. Soap & glycerine		1
71. Perfumes & cosmetics		1
72. Miscellaneous chemicals		1

[d]These textile and fabric sectors are aggregated because 90 percent or more of the output of these sectors either is used by one of the other sectors in the group or flows into household final demand.

lack of interest in the individual sectors for the problem at hand (40, p. 207).

The 39 x 39 aggregated flow table is given in Table VII-2. The six final demand sectors, except imports, and the unallocated column are aggregated into one sector, final demand, in Table VII-2. The unallocated sector has been aggregated into final demand and value added. The most desirable procedure would have been to allocate this sector among the first 77 x 77 sectors (66, p. 61). This procedure was not followed for two reasons. First, some of the sectors with large entries in the unallocated sector have no interindustry entries at all. Hence, any distribution among the intermediate sectors would be completely arbitrary. Second, the three sectors of direct concern 14, 19, and 20, use as inputs a relatively small proportion of the outputs of those sectors with unallocated output. The "primary" input sectors consumable stores, repairs, work done by others, postage and stationery, and non-industrial services have all been aggregated into the others sector, sector 40, of the 39 x 39 table. Finally, the depreciation and margin sectors have been aggregated together. The $(I - A)^{-1}$ matrix of the 39 x 39 table is given in Table VII-3.

P.L. 480 Aid to India

Historically, India has been by far the largest recipient of P.L. 480 commodity aid. Through fiscal year 1968-69 India received $4.333 billion P.L. 480 imports which was 42 percent of all P.L. 480 aid to all countries (27, p. 96). The proportion of aid imports in the total imports must be determined in order to illustrate the impact on aid imports.

Table VII-2. The flow table for the 39 aggregated sectors (million rupees, 1960-61 producer prices)

Sector		1	2	3
1.	Construction	926	0	0
2.	Electrical equipment	0	199	28
3.	Non-electrical equipment	0	10	208
4.	Transport equipment	0	0	16
5.	Metal products	650	17	21
6.	Metals	2503	448	436
7.	Minerals	99	2	0
8.	Rubber	0	12	1
9.	Consumer products	0	0	0
10.	Animal husbandry	0	0	0
11.	Flour milling	0	0	0
12.	Sugar	0	0	0
13.	Plantations	0	0	0
14.	Vegetable oils	0	0	0
15.	Vanaspati	0	0	0
16.	Starch	0	0	0
17.	Milk products	0	0	0
18.	Breweries & soft drinks	0	0	0
19.	Foodgrains	0	0	0
20.	Cotton	0	0	10
21.	Cotton products	0	14	0
22.	Jute	125	2	0
23.	Other textiles	0	0	3
24.	Man-made fibers	0	0	0
25.	Oil seeds	0	0	0
26.	Other crops	0	0	0
27.	Fertilizers	0	0	0
28.	Ceramics & bricks, etc.	1100	5	0
29.	Glass & glass-wares	35	13	0
30.	Wood products	457	43	16
31.	Forest products	1123	0	53
32.	Motor transport	0	0	0
33.	Petroleum	62	2	8
34.	Paper and paper products	0	22	10
35.	Other chemicals	204	60	32
36.	Insecticides & pesticides	0	0	0
37.	Railways	169	0	0
38.	Electricity	62	13	23
39.	Coal & coke	66	2	9
40.	Others	1082	239	371
41.	Depreciation & margin	3636	377	465
42.	Value added	6848	708	994
43.	Value of output	18978	2188	2704

Table VII-2. (continued)

Sector	4	5	6	7	8	9	10
1.	0	0	0	0	0	0	0
2.	14	0	0	0	0	0	0
3.	19	0	3	13	0	0	0
4.	619	0	0	0	0	0	0
5.	5	6	11	0	12	53	0
6.	706	1442	1591	0	10	17	0
7.	0	0	92	0	0	14	0
8.	150	0	0	0	270	4	0
9.	0	0	0	3	0	1413	0
10.	0	0	0	0	0	322	0
11.	0	0	0	0	0	50	0
12.	0	0	0	0	0	52	0
13.	0	0	0	0	146	0	0
14.	0	0	0	0	0	4	1000
15.	0	0	0	0	0	45	0
16.	0	0	0	0	0	0	0
17.	0	0	0	0	0	17	0
18.	0	0	0	0	0	0	0
19.	0	0	0	0	0	197	2969
20.	0	0	0	0	0	0	488
21.	0	0	0	0	31	3	0
22.	0	0	3	3	3	4	0
23.	0	0	0	0	96	4	0
24.	0	0	0	0	0	0	0
25.	0	0	0	0	0	0	0
26.	0	0	0	0	0	232	961
27.	0	0	0	0	0	20	0
28.	0	0	0	0	0	0	0
29.	0	0	0	4	1	5	0
30.	28	12	0	0	2	51	0
31.	42	2	2	0	0	40	0
32.	0	0	0	0	0	0	0
33.	16	25	18	1	10	14	0
34.	0	1	10	0	7	432	0
35.	77	75	19	0	73	73	158
36.	0	0	0	0	0	11	0
37.	0	0	792	333	0	45	0
38.	46	53	174	17	10	48	0
39.	9	27	252	0	2	27	0
40.	756	296	739	28	49	947	77
41.	777	963	1413	10	156	1484	172
42.	1469	1616	1652	529	325	10273	5802
43.	4793	4518	5979	608	1203	15853	11627

Table VII-2. (continued)

Sector	11	12	13	14	15	16	17
1.	0	0	0	0	0	0	0
2.	0	0	0	0	0	0	0
3.	0	0	0	0	0	0	0
4.	0	0	0	0	0	0	0
5.	0	0	0	58	40	0	11
6.	0	0	0	0	0	0	0
7.	0	6	0	0	0	0	0
8.	0	0	0	0	0	0	0
9.	0	0	0	0	0	4	15
10.	0	0	0	0	0	0	237
11.	0	0	0	0	0	0	1
12.	0	4697	0	0	0	0	2
13.	0	0	0	0	0	0	0
14.	0	0	0	0	772	0	3
15.	0	0	0	0	0	0	0
16.	0	0	0	0	0	0	1
17.	0	0	0	0	0	0	0
18.	0	0	0	0	0	0	0
19.	3184	158	0	0	0	36	7
20.	0	0	0	141	0	0	0
21.	0	0	0	0	0	0	0
22.	54	53	8	15	0	1	0
23.	0	3	0	0	0	0	0
24.	0	0	0	0	0	0	0
25.	0	0	0	4901	0	0	0
26.	0	63	0	0	0	0	1
27.	0	12	74	0	0	0	0
28.	0	0	0	0	0	0	0
29.	0	0	0	0	0	0	2
30.	0	0	55	0	0	0	3
31.	2	7	4	6	0	0	7
32.	0	0	0	0	0	0	0
33.	2	9	11	6	1	0	1
34.	0	7	10	0	0	0	3
35.	0	39	18	32	11	1	5
36.	0	7	0	0	0	0	0
37.	141	96	17	38	2	0	0
38.	22	60	1	6	5	2	4
39.	7	5	3	13	2	1	1
40.	91	360	88	22	6	7	34
41.	418	400	98	290	95	9	83
42.	246	4652	1771	820	87	13	57
43.	4026	10538	2141	6310	1019	74	478

Table VII-2. (continued)

Sector	18	19	20	21	22	23	24
1.	0	0	0	0	0	0	0
2.	0	0	0	0	0	0	0
3.	0	0	0	0	17	0	0
4.	0	0	0	0	0	0	0
5.	8	0	0	0	9	7	2
6.	0	0	0	6	0	0	0
7.	0	0	0	4	0	0	1
8.	0	0	0	0	4	1	0
9.	9	0	0	0	0	0	0
10.	0	0	0	14	0	164	0
11.	0	0	0	0	0	0	0
12.	34	0	0	0	0	0	0
13.	0	0	0	0	0	0	0
14.	0	0	0	0	0	1	0
15.	0	0	0	0	0	0	0
16.	0	0	0	61	3	6	0
17.	0	0	0	0	0	0	0
18.	3	0	0	0	0	0	0
19.	0	4065	72	0	43	0	0
20.	0	0	70	2727	0	3	0
21.	0	0	0	5335	6	311	1
22.	0	0	0	42	1377	48	3
23.	0	0	0	23	0	402	0
24.	0	0	0	0	0	513	0
25.	0	0	0	0	0	0	0
26.	0	536	28	0	18	66	0
27.	0	577	6	0	3	0	0
28.	0	0	0	0	0	0	0
29.	27	0	0	0	0	0	0
30.	5	0	0	17	0	19	4
31.	1	0	0	0	0	5	0
32.	0	0	0	0	0	0	0
33.	1	47	2	13	3	26	3
34.	0	0	0	41	2	11	72
35.	63	0	0	255	22	155	60
36.	0	47	3	0	2	0	0
37.	0	232	43	34	38	0	0
38.	4	90	5	184	38	45	10
39.	3	0	0	50	7	10	6
40.	36	726	38	247	101	449	31
41.	107	1460	69	1586	333	868	75
42.	175	38813	2617	3564	1842	1387	171
43.	476	46361	2910	14169	3830	4498	439

Table VII-2. (continued)

Sector	25	26	27	28	29	30	31
1.	0	0	0	0	0	0	0
2.	0	0	0	0	0	0	0
3.	0	0	0	0	0	0	0
4.	0	0	0	0	0	0	0
5.	0	0	0	6	1	1	0
6.	0	0	0	0	0	0	0
7.	0	0	56	76	8	0	0
8.	0	0	0	1	0	0	0
9.	0	0	0	0	0	0	0
10.	0	0	1	0	0	0	0
11.	0	0	0	0	0	0	0
12.	0	0	0	0	0	0	0
13.	0	0	0	0	0	0	0
14.	0	0	0	0	0	0	0
15.	0	0	0	0	0	0	0
16.	0	0	0	0	0	0	0
17.	0	0	0	0	0	0	0
18.	0	0	0	0	0	0	0
19.	218	70	0	1	2	0	0
20.	0	0	0	0	0	0	0
21.	0	0	0	0	0	0	0
22.	0	0	25	0	4	0	0
23.	0	0	0	0	0	0	0
24.	0	0	0	0	0	0	0
25.	508	0	0	0	0	0	0
26.	87	28	0	0	0	0	0
27.	17	0	4	0	0	0	0
28.	0	0	0	0	0	0	0
29.	0	0	0	0	10	0	0
30.	0	0	0	4	2	2	0
31.	0	0	3	20	6	330	0
32.	0	0	0	0	0	0	0
33.	7	2	3	11	18	3	0
34.	0	0	0	0	4	1	0
35.	0	0	23	4	70	14	0
36.	9	0	0	0	0	0	0
37.	52	0	0	0	10	0	123
38.	15	2	27	13	3	3	0
39.	0	0	25	41	15	2	0
40.	119	18	19	123	43	84	140
41.	218	20	141	245	20	123	0
42.	5422	2354	123	541	114	853	2094
43.	6620	2494	450	1086	320	1416	2234

Table VII-2. (continued)

Sector	32	33	34	35	36	37	38
1.	0	0	0	0	0	0	0
2.	0	0	0	0	0	0	0
3.	0	0	0	0	0	0	0
4.	372	0	0	0	0	581	0
5.	0	88	2	86	2	0	0
6.	0	0	0	17	0	0	0
7.	0	0	5	83	0	0	0
8.	250	0	0	0	0	0	0
9.	0	0	0	0	0	0	0
10.	0	0	0	14	0	0	0
11.	0	0	0	0	0	0	0
12.	0	0	0	9	0	0	0
13.	0	0	0	0	0	0	0
14.	0	0	0	352	0	0	0
15.	0	0	0	57	0	0	0
16.	0	0	0	2	0	0	0
17.	0	0	0	19	0	0	0
18.	0	0	0	13	1	0	0
19.	0	0	4	0	0	0	0
20.	0	0	0	6	0	0	0
21.	0	0	0	0	0	0	0
22.	0	0	26	15	0	0	0
23.	0	0	1	0	0	0	0
24.	0	0	0	4	0	0	0
25.	0	0	0	0	0	0	0
26.	0	0	12	79	0	0	0
27.	0	0	0	0	0	0	0
28.	0	0	0	0	0	0	0
29.	0	0	0	86	0	0	0
30.	0	0	4	68	2	0	0
31.	0	0	66	39	0	0	0
32.	0	0	0	0	0	0	0
33.	380	521	3	17	0	52	15
34.	0	0	86	48	0	0	0
35.	0	12	103	652	11	0	0
36.	0	0	0	3	8	0	0
37.	0	60	37	0	0	0	0
38.	0	10	50	70	1	58	0
39.	0	0	37	25	0	359	244
40.	135	110	86	497	12	280	216
41.	1673	71	274	662	17	860	503
42.	1950	357	262	1461	28	3577	864
43.	4760	1169	1021	4484	82	5767	1842

Table VII-2. (continued)

Sector	39	Imports	Final Demand	Output
1.	0	0	18053	18978
2.	0	1166	3113	2188
3.	52	2252	4634	2704
4.	0	543	3748	4793
5.	0	132	3554	4518
6.	0	1670	474	5979
7.	0	173	335	608
8.	0	68	578	1203
9.	0	310	14738	15873
10.	0	128	11003	11627
11.	0	294	4269	4026
12.	0	0	5744	10538
13.	0	0	1995	2141
14.	0	49	4226	6310
15.	0	0	917	1019
16.	0	0	1	74
17.	0	103	545	478
18.	0	0	459	476
19.	0	1785	37120	46361
20.	0	581	46	2910
21.	0	0	8468	14169
22.	0	88	2107	3830
23.	0	35	4001	4498
24.	0	101	23	439
25.	0	70	1281	6620
26.	0	0	383	2494
27.	0	254	-9	450
28.	0	24	5	1086
29.	0	3	140	320
30.	0	9	631	1416
31.	0	26	502	2234
32.	0	0	4760	4760
33.	1	685	540	1169
34.	0	207	461	1021
35.	0	640	2803	4484
36.	0	13	5	82
37.	671	0	2834	5767
38.	67	0	601	1842
39.	100	0	136	1486
40.	64	1212	4419	6459
41.	22	0	54698	0
42.	1180	0	15200	168250
43.	1486	12621	209912	

Table VII-3. The inverse of the (I-A) matrix[a]

Sector	1	2	3
1. Construction	1.051	0.0	0.0
2. Electrical equipment	3.715-5	1.100	1.239-2
3. Non-electrical equipment	1.343-3	6.712-3	1.084
4. Transport equipment	6.801-3	6.724-3	1.280-2
5. Metal products	3.799-2	1.072-2	1.006-2
6. Metals	2.072-1	3.147-1	2.488-1
7. Minerals	1.331-2	7.065-3	4.213-3
8. Rubber	3.629-4	8.061-3	1.123-3
9. Consumer products	7.645-5	5.121-5	2.723-5
10. Animal husbandry	8.859-5	2.582-4	1.465-4
11. Flour milling	3.864-7	5.315-7	2.446-7
12. Sugar	6.656-5	1.686-4	7.235-5
13. Plantations	4.404-5	9.784-4	1.363-4
14. Vegetable oils	1.454-3	3.703-3	1.592-3
15. Vanaspati	2.087-4	5.309-4	2.277-4
16. Starch	1.652-5	7.270-5	1.195-5
17. Milk products	6.957-5	1.770-4	7.591-5
18. Breweries & softdrinks	4.811-5	1.223-4	5.250-5
19. Foodgrains	3.144-4	4.774-4	2.616-4
20. Cotton	7.406-5	2.489-3	4.244-3
21. Cotton products	4.753-5	1.171-2	3.339-4
22. Jute	1.125-2	2.898-3	5.969-4
23. Other textiles	3.426-5	7.500-4	1.426-3
24. Man made fibers	1.854-5	1.228-4	1.786-4
25. Oil seeds	1.223-3	3.115-3	1.339-3
26. Other crops	3.837-4	1.023-3	4.808-4
27. Fertilizers	1.787-5	5.591-5	2.092-5
28. Ceramics & bricks, etc.	6.094-2	2.514-3	2.832-5
29. Glass & glass-wares	2.420-3	7.637-3	4.635-4
30. Wood products	2.600-2	2.256-2	7.082-3
31. Forest products	6.980-2	6.988-3	2.362-2
32. Motor transport	0.0	0.0	0.0
33. Petroleum	1.057-2	6.430-3	8.694-3
34. Paper & paper products	6.536-4	1.342-2	5.240-3
35. Other chemicals	1.640-2	4.175-2	1.791-2
36. Insecticides & pesticides	2.105-5	4.087-5	2.085-5
37. Railways	5.871-2	5.773-2	4.697-2
38. Electricity	1.326-2	1.958-2	1.902-2
39. Coal & coke	2.213-2	2.341-2	2.141-2

[a]The digits following the hyphens in the numbers are negative powers of ten by which the first four digits are multiplied: e.g., 3.715-5 in row 2 and column 1 is .00003715.

Table VII-3. (continued)

Sector	4	5	6	7	8	9
1.	0.0	0.0	0.0	0.0	0.0	0.0
2.	3.774-3	4.999-5	1.383-4	5.005-4	1.054-5	6.182-6
3.	5.931-3	1.802-3	4.560-3	2.522-2	5.001-4	2.506-4
4.	1.153	9.168-3	2.689-2	6.636-2	1.506-3	1.036-3
5.	3.549-3	1.004	3.678-3	1.559-3	1.724-2	4.391-3
6.	2.361-1	4.389-1	1.371	1.974-2	2.310-2	3.837-3
7.	4.187-3	7.178-3	2.123-2	1.001	3.183-3	1.626-3
8.	4.657-2	3.720-4	1.090-3	2.706-3	1.289	4.016-4
9.	2.999-5	4.403-5	1.166-4	5.421-3	6.804-5	1.098
10.	2.942-4	1.166-4	3.962-5	1.440-4	4.752-3	2.293-2
11.	3.345-7	3.328-7	4.240-7	1.712-5	1.145-6	3.461-3
12.	1.093-4	8.848-5	2.641-5	4.832-5	4.236-4	6.542-3
13.	5.652-3	4.514-5	1.323-4	3.284-4	1.565-1	4.874-5
14.	2.413-3	1.940-3	5.662-4	3.803-4	9.690-3	5.578-3
15.	3.442-4	2.784-4	8.143-5	6.652-5	1.335-3	3.251-3
16.	2.879-5	1.056-5	4.396-6	9.136-6	4.903-4	1.131-5
17.	1.147-4	9.279-5	2.716-5	2.286-5	4.449-4	1.222-3
18.	7.929-5	6.410-5	1.869-5	1.190-5	3.077-4	4.289-5
19.	2.300-4	1.334-4	7.022-5	3.040-4	2.609-3	2.545-2
20.	6.078-4	9.053-5	5.291-5	1.494-4	1.365-2	1.208-3
21.	2.421-3	2.149-5	6.160-5	1.686-4	6.592-2	3.968-4
22.	7.539-4	5.873-4	1.391-3	7.294-3	9.971-3	2.127-3
23.	4.094-3	3.360-5	1.040-4	2.702-4	1.131-1	3.773-4
24.	4.911-4	2.366-5	1.756-5	3.440-5	1.300-2	5.279-5
25.	2.030-3	1.632-3	4.763-4	3.199-4	8.152-3	4.693-3
26.	6.232-4	4.443-4	1.659-4	2.208-4	4.427-3	1.916-2
27.	2.073-4	8.287-6	8.117-6	2.962-5	5.548-3	1.741-3
28.	8.623-6	1.142-7	3.161-7	1.144-6	2.408-8	1.413-8
29.	6.327-4	4.869-4	2.735-4	6.883-3	3.277-3	5.927-4
30.	7.536.3	3.080-3	3.125-4	6.904-4	8.582-3	3.884-3
31.	1.241-2	1.713-3	1.089-3	1.454-3	4.335-3	5.957-3
32.	0.0	0.0	0.0	0.0	0.0	0.0
33.	1.045-2	1.446-2	1.241-2	1.434-2	2.433-2	2.541-3
34.	1.262-3	1.326-3	2.618-3	4.774-4	1.317-2	3.280-2
35.	2.707-2	2.189-2	6.380-3	4.024-3	1.050-1	1.094-2
36.	2.462-5	1.938-5	6.500-6	1.276-5	1.148-4	8.942-4
37.	4.365-2	7.914-2	2.321-1	5.721-1	1.299-2	8.938-3
38.	2.058-2	2.782-2	4.733-2	3.761-2	1.768-2	5.992-3
39.	1.927-3	3.574-2	8.441-2	4.508-2	9.479-3	5.147-3

Table VII-3. (continued)

Sector	10	11	12	13	14	15
1.	0.0	0.0	0.0	0.0	0.0	0.0
2.	2.401-6	2.108-5	1.053-5	9.555-6	8.434-6	1.124-5
3.	6.790-5	4.197-4	2.748-4	3.680-4	2.073-4	3.588-4
4.	5.065-4	5.074-3	2.304-3	1.669-3	1.890-3	2.227-3
5.	1.259-3	3.831-4	5.248-4	1.108-3	9.699-3	4.717-2
6.	7.526-4	1.292-3	8.000-4	9.696-4	4.681-3	2.114-2
7.	8.178-4	1.400-3	1.519-3	4.634-3	5.267-4	9.308-4
8.	2.153-5	2.346-4	1.129-4	7.998-5	8.180-5	9.434-5
9.	8.546-6	9.141-6	1.135-5	2.862-5	4.945-6	9.822-6
10.	1.000	3.128-5	7.204-5	1.476-4	4.116-5	1.027-4
11.	1.770-7	1.000	1.125-7	2.073-7	7.488-8	1.968-7
12.	6.903-5	6.248-6	1.804	5.399-5	2.909-5	7.707-5
13.	2.613-6	2.847-5	1.370-5	1.000	9.927-6	1.145-5
14.	8.751-2	1.040-4	7.695-4	1.177-3	1.001	7.593-1
15.	2.152-4	1.464-5	1.101-4	1.679-4	8.503-5	1.000
16.	8.321-6	1.800-5	1.653-5	1.334-5	6.241-6	1.103-5
17.	7.127-5	4.880-6	3.670-5	5.597-5	2.835-5	7.930-5
18.	5.548-5	1.548-5	4.217-5	3.873-5	3.592-5	6.717-5
19.	2.865-1	8.675-1	3.025-2	2.373-4	3.144-2	2.390-2
20.	4.504-2	2.019-5	5.480-5	5.832-5	2.292-2	1.742-2
21.	3.162-6	6.734-5	1.054-4	2.801-5	1.436-5	1.296-5
22.	7.730-4	2.191-2	1.451-2	9.188-3	3.992-3	3.133-3
23.	2.224-6	2.123-5	5.760-4	1.322-5	7.561-6	9.058-6
24.	1.535-5	3.447-6	7.342-5	1.329-5	6.829-6	1.772-5
25.	7.362-2	8.753-5	6.474-4	9.899-4	8.418-1	6.387-1
26.	8.867-2	1.027-2	1.153-2	3.717-4	1.192-2	9.300-3
27.	3.884-3	1.091-2	2.466-3	3.489-2	2.627-3	1.994-3
28.	5.487-9	4.818-8	2.407-8	2.184-8	1.927-8	2.569-8
29.	3.442-4	3.353-5	1.845-4	2.955-4	1.383-4	3.812-4
30.	2.802-4	7.708-5	1.931-4	2.597-2	1.748-4	4.554-4
31.	3.494-4	6.539-4	1.460-3	8.639-3	1.104-3	1.085-3
32.	0.0	0.0	0.0	0.0	0.0	0.0
33.	1.320-3	3.577-3	3.526-3	1.030-2	3.991-3	5.636-3
34.	2.089-4	3.366-5	1.440-3	5.292-3	9.652-5	2.824-4
35.	1.692-2	1.149-3	8.657-3	1.320-2	6.688-3	1.871-2
36.	4.973-4	9.882-4	1.378-3	1.699-5	1.337-3	1.025-3
37.	4.374-3	4.383-2	1.990-2	1.441-2	1.632-2	1.923-2
38.	1.654-3	8.979-3	1.139-2	3.854-3	3.975-3	9.457-3
39.	1.125-3	6.842-3	4.206-3	5.506-3	4.359-3	7.941-3

Table VII-3. (continued)

Sector	16	17	18	19	20	21
1.	0.0	0.0	0.0	0.0	0.0	0.0
2.	1.549-5	6.317-6	1.408-5	4.121-6	6.956-6	1.140-5
3.	9.202-4	2.736-4	7.204-4	1.186-4	7.745-5	5.016-4
4.	1.559-3	9.960-4	1.828-3	8.619-4	1.890-3	1.768-3
5.	8.099-4	2.461-2	2.181-2	2.391-4	1.706-4	1.106-3
6.	1.049-3	1.114-2	1.094-2	3.103-4	4.755-4	2.059-3
7.	1.256-3	1.088-3	5.097-3	1.740-3	3.246-4	1.289-3
8.	1.123-4	5.311-5	8.568-5	3.651-5	7.667-5	8.360-5
9.	5.935-2	3.458-2	2.096-2	1.005-5	2.173-6	4.258-4
10.	1.342-3	4.967-1	1.348-3	3.667-5	7.987-6	1.885-3
11.	1.872-4	2.201-3	6.760-5	4.141-8	1.053-8	1.655-6
12.	4.220-4	7.850-3	1.305-1	6.429-6	3.585-6	1.454-4
13.	1.363-5	6.446-6	1.040-5	4.430-6	9.304-6	1.015-5
14.	1.782-3	5.118-2	1.552-2	9.986-5	3.724-5	3.277-3
15.	3.879-4	4.008-4	2.273-3	1.397-5	5.275-6	4.501-4
16.	1.000	2.104-3	8.214-5	1.477-6	3.911-7	6.933-3
17.	1.368-4	1.000	7.602-4	4.658-6	1.759-6	1.501-4
18.	5.870-5	7.346-5	1.007	1.834-5	1.597-5	1.081-4
19.	5.352-1	1.624-1	4.039-3	1.097	2.811-2	1.318-2
20.	1.417-4	2.257-2	6.599-4	6.803-6	1.025	3.166-1
21.	8.124-5	1.851-5	2.582-5	4.989-6	4.560-6	1.604
22.	2.192-2	1.116-3	3.443-3	1.216-3	2.218-4	8.142-3
23.	2.981-5	2.594-5	5.899-5	3.375-6	6.830-6	2.874-3
24.	1.882-5	2.420-5	1.621-4	1.363-6	1.149-6	3.593-4
25.	1.499-3	4.305-2	1.305-2	8.401-5	3.133-5	2.757-3
26.	7.708-3	4.741-2	4.604-3	1.285-2	1.031-2	4.214-3
27.	6.818-3	2.252-3	2.656-4	1.377-2	2.485-3	8.387-4
28.	3.540-8	1.444-8	3.218-8	9.417-9	1.590-8	2.604-8
29.	3.742-4	4.814-3	6.245-2	3.468-5	1.146-5	7.151-4
30.	4.995-4	6.904-3	1.379-2	5.399-5	4.847-5	2.536-3
31.	6.344-4	1.727-2	8.464-3	1.259-4	5.060-5	1.315-3
32.	0.0	0.0	0.0	0.0	0.0	0.0
33.	2.099-3	5.788-3	1.253-2	2.390-3	1.691-3	4.148-3
34.	1.996-3	8.270-3	3.681-3	1.604-5	7.317-6	5.591-3
35.	1.728-2	2.382-2	1.741-1	1.097-3	4.145-4	3.531-2
36.	6.750-4	3.237-4	2.682-4	1.233-3	1.203-3	4.119-4
37.	1.343-2	8.593-3	1.576-2	7.443-3	1.634-2	1.526-2
38.	3.045-2	1.118-2	1.460-2	3.258-3	2.292-3	2.344-2
39.	2.053-2	6.138-3	1.509-2	1.809-3	1.595-3	1.118-2

Table VII-3. (continued)

Sector	22	23	24	25	26	27
1.	0.0	0.0	0.0	0.0	0.0	0.0
2.	9.655-5	9.541-6	2.638-5	4.352-6	2.285-7	1.132-4
3.	7.809-3	5.376-4	1.425-3	6.537-5	8.480-6	6.398-3
4.	2.363-3	1.064-3	3.159-3	1.123-3	4.106-5	1.254-2
5.	4.270-3	5.042-3	1.004-2	2.386-4	1.189-4	2.832-3
6.	4.161-3	2.973-3	6.271-3	3.479-4	6.217-5	5.516-3
7.	4.768-4	1.897-3	6.764-3	4.268-4	5.060-5	1.269-1
8.	2.203-3	3.875-4	1.541-4	4.577-5	1.709-6	6.298-4
9.	7.914-5	1.463-4	8.138-5	2.878-6	2.968-7	7.060-4
10.	7.681-5	4.055-2	9.717-4	1.034-5	1.152-6	2.586-3
11.	3.516-7	1.098-6	1.883-6	1.380-8	1.396-9	2.779-6
12.	4.835-5	2.905-4	7.399-4	4.817-6	2.664-7	2.558-4
13.	2.673-4	4.703-5	1.870-5	5.554-6	2.074-7	7.643-5
14.	1.022-3	1.006-2	1.626-2	4.789-5	4.677-6	5.726-3
15.	1.466-4	9.135-4	2.332-3	6.785-6	6.609-7	7.954-4
16.	1.246-3	2.042-3	1.148-4	4.918-7	5.179-8	9.926-5
17.	4.888-5	3.045-4	7.775-4	2.262-6	2.203-7	2.652-4
18.	4.510-5	2.111-4	5.374-4	2.213-5	5.814-7	1.834-4
19.	2.021-2	1.455-2	2.111-3	3.956-2	3.113-2	2.152-3
20.	8.688-4	2.695-2	1.407-3	3.141-6	2.953-7	4.031-4
21.	4.040-3	1.223-1	3.733-3	3.135-6	1.785-7	2.583-4
22.	1.562	2.179-2	1.907-2	2.941-4	3.471-5	8.895-2
23.	2.110-4	1.098	2.172-4	4.107-6	1.615-7	6.467-5
24.	3.433-5	1.253-1	1.000	9.440-7	6.474-8	6.305-5
25.	8.598-4	8.467-3	1.368-2	1.083	3.935-6	4.817-3
26.	7.908-3	2.194-2	5.828-3	1.487-2	1.012	1.868-3
27.	1.502-3	2.802-4	8.155-5	3.304-3	3.909-4	1.009
28.	2.206-7	2.180-8	6.028-8	9.946.9	5.222-10	2.586-7
29.	2.366-4	1.449-3	3.713-3	1.483-5	1.410-6	2.111-3
30.	2.946-4	7.174-3	1.272-2	5.736-5	2.286-6	1.098-3
31.	4.346-4	5.308-3	1.645-2	5.233-5	4.282-6	7.873-3
32.	0.0	0.0	0.0	0.0	0.0	0.0
33.	3.137-3	1.470-2	1.630-2	2.423-3	1.547-3	1.640-2
34.	1.107-3	2.666-2	1.814-1	8.264-6	8.618-7	8.874-4
35.	1.152-2	7.183-2	1.835-1	5.331-4	5.192-5	6.241-2
36.	9.373-4	1.261-4	1.722-4	1.677-3	3.503-5	1.086-4
37.	1.997-2	9.162-3	2.722-2	9.701-3	3.544-4	1.080-1
38.	1.682-2	1.920-3	3.725-2	2.987-3	9.270-4	7.120-2
39.	7.286-3	1.009-2	3.058-2	1.294-3	1.828-4	7.845-2

Table VII-3. (continued)

Sector	28	29	30	31	32	33
1.	0.0	0.0	0.0	0.0	0.0	0.0
2.	6.288-5	7.073-5	6.991-6	2.332-5	2.993-4	4.781-5
3.	3.465-3	3.319-3	1.308-4	1.822-4	5.425-4	6.599-4
4.	7.285-3	1.025-2	1.712-3	6.611-3	9.122-2	1.254-2
5.	7.225-3	1.727-2	1.284-3	9.305-5	1.212-2	1.370-1
6.	5.428-3	1.172-2	9.949-4	1.418-3	2.464-2	6.237-2
7.	7.018-2	3.124-2	2.466-4	2.529-5	6.095-4	1.441-3
8.	1.484-3	4.463-4	6.936-5	2.670-4	7.141-2	5.070-4
9.	3.814-4	2.335-4	4.123-6	1.825-7	7.011-6	1.370-5
10.	4.035-5	1.420-3	6.250-5	1.773-6	2.832-4	1.333-4
11.	1.249-6	3.133-6	1.185-7	2.087-9	1.075-7	2.660-7
12.	2.338-5	1.091-3	4.798-5	6.883-7	3.888-5	1.014-4
13.	1.801-4	5.416-5	8.418-6	3.241-5	8.666-3	6.153-5
14.	4.664-4	2.396-2	1.054-3	1.519-5	8.753-4	2.227-3
15.	6.770-5	3.438-3	1.512-4	2.168-6	1.225-4	3.196-4
16.	3.375-6	1.413-4	5.526-6	1.726-7	2.894-5	1.179-5
17.	2.262-5	1.146-3	5.042-5	7.227-7	4.084-5	1.065-4
18.	1.537-5	7.921-4	3.484-5	4.994-7	2.823-5	7.360-5
19.	1.061-3	8.909-3	6.984-5	1.426-6	1.663-4	1.413-4
20.	4.833-5	1.010-3	4.444-5	4.110-6	7.722-4	9.909-5
21.	7.863-5	8.421-5	4.066-6	1.392-5	3.653.3	2.722-5
22.	6.024-4	2.274-2	1.114-4	4.518-6	6.012-4	2.333-4
23.	1.347-4	6.248-5	7.251-6	2.366-5	6.266-3	4.582-5
24.	2.004-5	2.484-4	1.144-5	2.850-6	7.232-4	2.765-5
25.	3.924-4	2.016-2	8.869-4	1.278-5	7.264-4	1.874-3
26.	1.270-4	5.648-3	2.423-4	3.891-6	3.207-4	4.948-4
27.	2.171-5	1.876-4	3.709-6	1.194-6	3.083-4	9.300-6
28.	1.000	1.616-7	1.598-8	5.328-8	6.839-7	1.093-7
29.	5.831-4	1.038	2.396-4	3.952-6	2.599-4	5.129-4
30.	3.865-3	1.083-2	1.002	4.454-5	1.106-3	8.342-4
31.	1.952-2	2.567-2	2.336-1	1.000	1.250-3	6.610-4
32.	0.0	0.0	0.0	0.0	1.000	0.0
33.	2.012-2	1.097-1	4.260-3	1.003-3	1.464-1	1.808
34.	1.249-4	1.745-2	9.206-4	8.178-6	8.270-4	4.617-4
35.	5.241-3	2.704-1	1.190-2	1.705-4	9.636-3	2.513-2
36.	6.382-6	2.562-4	1.039-5	1.552-7	9.704-6	2.195-5
37.	6.277-2	8.838-2	1.479-2	5.713-2	1.274-2	1.084-1
38.	1.735-2	2.148-2	2.755-3	8.787-4	4.231-3	2.123-2
39.	4.753-2	6.423-2	3.075-3	4.019-3	3.135-3	1.417-2

Table VII-3. (continued)

Sector	34	35	36	37	38	39
1.	0.0	0.0	0.0	0.0	0.0	0.0
2.	5.811-5	2.299-5	6.361-6	4.235-4	8.973-5	6.744-4
3.	2.618-3	1.164-3	3.113-4	3.310-3	5.644-3	4.256-2
4.	8.803-3	3.028-3	8.759-4	1.201-1	7.917-3	5.900-2
5.	5.738-3	2.555-2	3.127-2	1.690-3	1.295-3	1.357-3
6.	5.535-3	1.808-2	1.477-2	2.575-2	3.423-3	2.201-2
7.	7.950-3	2.285-2	3.667-3	4.594-4	6.268-5	3.845-4
8.	4.170-4	1.337-4	3.732-5	4.850-3	3.229-4	2.406-3
9.	7.590-5	4.002-4	3.440-4	3.315-6	4.638-7	2.659-6
10.	7.304-4	6.178-3	9.415-4	3.221-5	3.917-6	2.137-5
11.	1.400-6	1.173-5	2.669-6	3.790-8	5.875-9	2.800-8
12.	5.282-4	4.762-3	2.475-3	1.250-5	2.009-6	8.937-6
13.	5.061-5	1.622-5	4.529-6	5.886-4	3.918-5	2.920-4
14.	1.161-2	1.046-1	1.585-2	2.759-4	4.424-5	1.970-4
15.	1.665-3	1.501-2	2.274-3	3.938-5	6.330-6	2.814-5
16.	9.709-5	5.435-4	8.234-5	3.135-6	3.599-7	1.992-6
17.	5.549-4	5.004-3	7.580-4	1.313-5	2.110-6	9.381-6
18.	3.838-4	3.458-3	1.412-2	9.070-6	1.458-6	6.484-6
19.	6.391-3	6.519-3	1.029-3	2.590-5	4.152-6	2.266-5
20.	5.397-4	4.291-3	6.508-4	7.464-5	2.687-5	1.967-4
21.	2.652-4	3.289-5	6.175-6	2.528-4	1.821-5	1.358-4
22.	4.437-2	7.874-3	1.236-3	8.207-5	1.022-5	6.279-5
23.	1.217-3	3.031-5	6.956-6	4.296-4	3.524-5	2.632-4
24.	2.556-4	1.057-3	1.603-4	5.176-5	4.464-6	3.200-5
25.	9.764-3	8.803-2	1.333-2	2.321-4	3.721-5	1.658-4
26.	1.584-2	2.310-2	3.515-3	7.067-5	1.107-5	5.314-5
27.	1.442-4	3.316-4	5.323-5	2.169-5	1.582-6	1.137-5
28.	1.328-7	5.254-8	1.454-8	9.678-7	2.050-7	1.541-6
29.	2.672-3	2.376-2	4.395-3	7.178-5	1.120-5	5.305-5
30.	6.400-3	1.834-2	3.007-2	8.090-4	9.455-5	6.625-4
31.	7.353-2	1.618-2	8.882-3	1.355-3	2.111-4	1.553-3
32	0.0	0.0	0.0	0.0	0.0	0.0
33.	9.524-3	1.235-2	2.730-3	1.822-2	1.621-2	1.234-2
34.	1.094	1.443-2	2.256-3	1.485-4	3.962-5	2.708-4
35.	1.309-1	1.181	1.788-1	3.097-3	4.979-4	2.213-3
36.	1.457-4	1.029-3	1.108	2.819-6	4.683-7	2.186-6
37.	7.594-2	2.611-2	7.553-3	1.038	6.811-2	5.075-1
38.	6.019-2	2.262-2	1.800-2	1.596-2	1.008	5.717-2
39.	5.749-2	1.515-2	5.503-3	7.299-2	1.479-1	1.115

As mentioned above, our concern is with foodgrains, cotton, and vegetable oils, sectors 19, 20, and 14 respectively. The levels of total imports and P.L. 480 Title I imports of those commodities are given in Tables VII-4, VII-5, and VII-6 respectively for the years 1964-69 inclusive. These tables show that Title I P.L. 480 imports comprised 76 percent, 31 percent, and 103 percent of total imports of sectors 19, 20, and 14 respectively on the average for the period 1964-69.[1] Consequently, it is assumed for the purpose of illustration that aid comprised 75 percent, 30 percent, and 100 percent of the total imports of sectors 19, 20, and 14 respectively.

Substitution of Aid for Domestic Production in Final Demand

The first discussion of analyzing the impact of aid in Chapter IV was that of class III imports. There it was shown how the impact of the aid on domestic production can be determined with equation 4.4. That method is applied to the foodgrains sector, sector 19. Recall that y^a is the change in final demand from domestic production. Foodgrain imports were 1785 million rupees. It is assumed that 75 percent or 1339 million rupees are aid imports. Assuming all these aid imports were distributed directly to final demand, the value of y^a_{19} is then -1339 and all other elements of y^a are zero. The impact of this aid on the output of the 39 sectors is shown in Table VII-7. The second approach is employed here, i.e., calculating the effects of the aid rather than comparing the sectoral outputs of the economy.

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[1] See footnote b of Table VII-6 for an explanation of the 103 percent.

Table VII-4. Foodgrain imports[a]

Year	Total imports (1000 m.t.)	P.L. 480 Title I imports (1000 m.t.)	Title I as percent of total
1964	6378	5416	85
1965	7595	6354	84
1966	10399	8059	77
1967	8737	5962	68
1968	5740	4209	73
1969	3872	2568	66
Average	7120	5428	76

[a]Source: (4, Tables 16 and 17).

Table VII-5. Cotton imports

Year	Total imports[a] (Indian bales)	P.L. 480 Title I imports[b] (Indian bales)	Title I as percent of total
1964	803,501	344,942	43
1965	695,183	158,169	23
1966	443,396	3,061	1
1967	854,792	258,246	30
1968	813,062	329,102	40
1969	602,387	230,726	38
Average	702,053	220,708	31

[a]Source: (21, Table 102).

[b]Source: (4, Table 17).

Table VII-6. Vegetable oil imports

Year	Total[a] (m.t.) Oils	Total[a] (m.t.) Oils, cakes and meals	P.L. 480 Title I[c] (m.t.)	Title I as percent of total[b] Oils	Title I as percent of total[b] Oils, cakes and meals
1964	36,788	39,888	0	0	0
1965	55,196	62,396	71,500	130	114
1966	44,324	48,724	31,300	71	64
1967	59,971	69,071	87,200	145	126
1968	37,541	43,141	62,900	167	146
1969	84,292	94,192	117,900	140	125
Average	53,019	59,669	61,800	116	103

[a]Source: (21, Tables 68, 110-121). For total imports, the sum of all vegetable oils as well as oilseed cake and meal and other vegetable oil residues was calculated because Saluja includes oilseed cake and meal in the vegetable oils sector. The oils included are soybean, cottonseed, groundnut, olive, sunflower, rape, colza, mustard, linseed, palm, coconut, palm kernal, castor, and tung oil.

[b]The logical inconsistency of the part greater than the whole remains an unexplainable data phenomenon. The FAO data is consistent within 1 percent of the data in the Bulletin on Food Statistics (13), except that there vegetable oil imports for 1965 are given as 67,199 rather than 55,196 m.t. That change would lessen the inconsistency but does not eliminate it. The data for P.L. 480 given above is consistent with the 1964-69 annual reports on P.L. 480 (22, 23, 24, 25, 26, 27). The total of oils and fats delivered as reported by the American Embassy for the six year period is 95 percent of the signed agreements reported in the annual reports. Part of the discrepancy may be that not all of the aid imports are recorded in total imports.

[c]Source: (4, Table 17).

Table VII-7. Decrease in sectoral outputs because of foodgrain imports[a] (million rupees, 1960-61 producer prices)

Sector	Foodgrain Imports	
	1339.0	1.0
1. Construction	0.0	0.0
2. Electrical equipment	5.518-3	4.121-6
3. Non-electrical equipment	1.588-1	1.186-4
4. Transport equipment	1.154	8.619-4
5. Metal products	3.202-1	2.391-4
6. Metals	4.155-1	3.103-4
7. Minerals	2.330	1.740-3
8. Rubber	4.888-2	3.651-5
9. Consumer products	1.346-2	1.006-5
10. Animal husbandry	4.910-2	3.667-5
11. Flour milling	5.545-5	4.141-8
12. Sugar	8.609-3	6.429-6
13. Plantations	5.932-3	4.430-6
14. Vegetable oils	1.337-1	9.986-5
15. Vanaspati	1.871-2	1.397-5
16. Starch	1.978-3	1.477-6
17. Milk products	6.237-3	4.658-6
18. Breweries and softdrinks	2.455-2	1.834-5
19. Foodgrains	1468.259	1.097
20. Cotton	9.109-3	6.803-6
21. Cotton products	6.680-3	4.989-6
22. Jute	1.628	1.216-3
23. Other textiles	4.519-3	3.375-6
24. Man made fibers	1.825-3	1.363-6
25. Oil seeds	1.125-1	8.401-5
26. Other crops	17.208	1.285-2
27. Fertilizers	18.439	1.377-2
28. Ceramics and bricks, etc.	1.261-5	9.417-9
29. Glass and glass-wares	4.644-2	3.468-5
30. Wood products	7.229-2	5.399-5
31. Forest products	1.686-1	1.259-4
32. Motor transport	0.0	0.0.
33. Petroleum	3.200	2.390-3
34. Paper and paper products	2.147-2	1.604-5
35. Other chemicals	1.469	1.097-3
36. Insecticides and pesticides	1.652	1.233-3
37. Railways	9.966	7.443-3
38. Electricity	4.363	3.258-3
39. Coal and coke	2.423	1.809-3

[a]The digits following the hyphens in the numbers are negative powers of ten by which the first four digits are multiplied.

The sectoral output of the Indian economy given in Table VII-2 includes the effects of 1785 million rupees of foodgrain imports. To determine the outputs assuming there were no aid imports, i.e., imports were reduced to 446 million rupees, the sectoral output effects of the aid given in column 1 of Table VII-7 must be added to the sectoral output levels given in Table VII-2.

The total of the decrease of all sectors caused by one million rupees of foodgrain imports is 1,146,000 rupees.[1] Of that total, 1,097,000 rupees (96 percent) of the decrease is accounted for by the foodgrains sector. The total gross negative impacts were 114.6 percent of the aid. The impact on the foograins sector was 109.7 percent of the aid.

A review of Table VII-7 shows those sectors other than foodgrains which have the larger decreases are the sectors which supply imputs into the foodgrains sector. The sectors which have direct input flows to foodgrains are 26, 27, 33, 36, 37, and 38 as shown by column 19 of Table VII-2. The other sectors shown by Table VII-7 to have a decrease in output of more than 10,000 rupees are 7 (minerals), 22 (jute), 35 (other chemicals), and 39 (coal and coke). By following the backward linkages of Table VII-2 one more step it is seen that sector 27 (fertilizers) has inputs from each of sectors 7, 22, 35, and 39. In addition sector 35 has inputs flowing to sectors 33 and 36 and sector 39

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[1] In the summary of total impacts, the totals are rounded to the nearest 1,000 rupees because of the question of significance of more digits. This question arises because of the addition of numbers with a wide range of magnitude.

has inputs flowing to sectors 37 and 38. Thus, the sectors, other than foodgrains itself, with the greater decreases are those which directly, or nearly so, provide inputs for foodgrain production.

Required Final Demand with Minimum Domestic Production

An alternative approach of policy interest is to reverse the endogenous and exogenous role of total output and final demand of the sector receiving aid. This shows how much final demand must be expanded to accommodate the aid.

Suppose it is desired that output of the sector for which class III aid imports are to be received is to decline by only 25 percent of the quantity of the imports. In the previous section it was shown that 1339 million rupees of aid imports caused a decreased foodgrains output of 1468 million rupees.

For a policy of holding the output decline to only 25 percent of the aid, 335 million rupees, the unknowns are the required increase in final demand for foodgrains and the output effect on the other sectors. This is accomplished by switching q^a_{19} and y^a_{19} in equation 4.4 and setting q^a_{19} equal to -335.

Table VII-8 shows that if the output of foodgrains is permitted to decline by 335 billion rupees, final demand must decline by 306 million rupees. But the increase in imports is 1339 million rupees and final demand must expand by that quantity. Thus, there are two partially offsetting effects on final demand. The net result is that the final demand for foodgrains must be 1033 million rupees, as calculated by subtracting the smaller decline from the larger increase. That is,

Table VII-8. Decrease in final demand for foodgrain and output of other sectors because of a decline in foodgrain production[a] (million rupees, 1960-61 producer prices)

Sector	Decline in foodgrain production 335.0	1.0
1. Construction	0.0	0.0
2. Electrical equipment	1.259-3	3.758-6
3. Non-electrical equipment	3.624-2	1.082-4
4. Transport equipment	2.633-1	7.860-4
5. Metal products	7.305-2	2.181-4
6. Metals	9.479-2	2.830-4
7. Minerals	5.315-1	1.587-3
8. Rubber	1.115-2	3.329-5
9. Consumer products	3.071-3	9.167-6
10. Animal industry	1.120-2	3.344-5
11. Flour milling	1.265-5	3.776-8
12. Sugar	1.964-3	5.863-6
13. Plantations	1.354-3	4.040-6
14. Vegetable oils	3.051-2	9.107-5
15. Vanaspati	4.268-3	1.247-5
16. Starch	4.513-4	1.347-6
17. Milk products	1.423-3	4.248-6
18. Breweries and softdrinks	5.602-3	1.672-5
19. Foodgrains	305.508	9.120-1
20. Cotton	2.078-3	6.204-6
21. Cotton products	1.524-3	4.549-6
22. Jute	3.715-1	1.109-3
23. Other textiles	1.031-3	3.077-6
24. Man made fibers	4.165-4	1.243-6
25. Oil seeds	2.567-2	7.662-5
26. Other crops	3.926	1.172-2
27. Fertilizers	4.207	1.256-2
28. Ceramics and bricks, etc.	2.877-6	8.588-9
29. Glass and glass-wares	1.060-2	3.163-5
30. Wood products	1.649-2	4.923-5
31. Forest products	3.848-2	1.149-4
32. Motor transport	0.0	0.0
33. Petroleum	7.302-1	2.180-3
34. Paper and paper products	4.899-3	1.462-5
35. Other chemicals	3.351-1	1.000-3
36. Insecticides and pesticides	3.768-1	1.125-3
37. Railways	2.274	6.788-3
38. Electricity	9.955-1	2.972-3
39. Coal and Coke	5.528-1	1.650-3

[a]The digits following the hyphens in the numbers are negative powers of ten by which the first four digits are multiplied.

if foodgrain imports of 1339 million rupees are permitted to depress foodgrain production by only 335 million rupees, final demand for foodgrains must rise by 1033 million rupees.

The decrease in the sector outputs, other than foodgrains, given in the second column of Table VII-8 are similar but slightly less than those in the second column of Table VII-7. A unit decline in foodgrain production has a smaller impact than a unit decline in final demand for goodgrains. This is because not all the foodgrains are used for final demand: some of them are used to meet interindustry demand.

Required Output and Final Demand with Imports Used in Production

When imports are used in intermediate demand, expanding the final demand of a sector which uses the aid may be more appropriate than expanding the final demand of the sector into which the aid is classified. For example, 88 percent of P.L. 480 Title I foodgrain imports into India from 1956 to 1969 inclusive were wheat. The wheat at one time or another is milled. Hence, final demand for the flour milling sector could be expanded to utilize wheat imports rather than the final demand for foodgrains.

This argument is even greater in the case of cotton. Nearly all the cotton is used in intermediate demand as shown in Table VII-2. Cotton yarn, which has been aggregated into the cotton products sector, has by far the largest intermediate demand for cotton. The expansion of final demand for the cotton sector alone is inappropriate if cotton aid imports are to be prevented from substituting for domestic cotton production. Rather, final demand for the cotton products sector needs to expand

because it represents the majority of the ultimate final demand for cotton. The required final demand for cotton products can be determined. Let the level of domestic production of cotton remain at its current level of 2910 million rupees. The aid imports equal 174 million rupees of cotton since 30 percent of the total 581 million rupees of cotton imports are assumed to be aid. The impact on the production of all sectors other than cotton and the necessary increase in final demand for cotton products is found by setting q^a_{20} and y^a_{20} equal to zero and 174 respectively in equation 4.4 and solving for the other elements of q^a and y^a_{21}. The results are given in Table VII-9.

Table VII-9 shows that the output and final demand of the cotton products sector must increase by 903 and 563 million rupees respectively if 174 million rupees of cotton imports are prevented from depressing the output of the cotton sector. Keep in mind that q^a_{20} and y^a_{21} have switched positions so that y^a_{21} is shown in the row of sector 20 in Table VII-9. The other rows in the table show the required increase in their outputs. Again the sectors with the greatest increases are the ones providing the inputs into the cotton products sector because it has by far the greatest output increase. From the table it can be shown that the total of the output increases of all sectors is 5,831,000 million rupees for one million rupees of cotton imports. Of that total, 5,192,000 (89 percent) of the increase occurred in the cotton products sector.

Table VII-9. Increase in final demand for cotton products and production of other sectors because of cotton imports[a] (million rupees, 1960-61 producer prices)

Sector	Cotton imports	
	174.0	1.0
1. Construction	0	0
2. Electrical equipment	5.207-3	2.993-5
3. Non-electrical equipment	2.690-1	1.546-3
4. Transport equipment	6.670-1	3.833-3
5. Metal products	5.934-1	3.410-3
6. Metals	1.077	6.189-3
7. Minerals	6.695-1	3.848-3
8. Rubber	3.374-2	1.939-4
9. Consumer products	2.394-1	1.376-3
10. Animal husbandry	1.060	6.093-3
11. Flour milling	9.303-4	5.347-6
12. Sugar	8.129-2	4.672-4
13. Plantations	4.095-3	2.354-5
14. Vegetable oils	1.839	1.057-2
15. Vanaspati	2.526-1	1.451-3
16. Starch	3.904	2.244-2
17. Milk products	8.422-2	4.840-4
18. Breweries and softdrinks	5.809-2	3.338-4
19. Foodgrains	2.531	1.455-2
20. Cotton	563.175	3.237
21. Cotton products	903.479	5.192
22. Jute	4.547	2.613-2
23. Other textiles	1.617	9.295-3
24. Man made fibers	2.021-1	1.162-3
25. Oil seeds	1.547	8.891-3
26. Other crops	5.791-1	3.328-3
27. Fertilizers	3.993-2	2.295-4
28. Ceramics and bricks, etc.	1.190-5	6.839-8
29. Glass and glass-wares	4.007-1	2.303-3
30. Wood products	1.420	8.160-3
31. Forest products	7.318-1	4.206-3
32. Motor transport	0.0	0.0
33. Petroleum	2.042	1.173-2
34. Paper and paper products	3.147	1.809-2
35. Other chemicals	19.814	1.139-1
36. Insecticides and pesticides	2.274-2	1.307-4
37. Railways	5.750	3.304-2
38. Electricity	12.804	7.359-2
39. Coal and coke	6.019	3.459-2

[a]The digits following the hyphens in the numbers are negative powers of ten by which the first four digits are multiplied.

The Combined Impacts of Several Commodities of Aid Imports

It was shown in Chapter IV that as long as the same variables are endogenous and exogenous in the model, the effects of several impacts can be combined into a single calculation. In Table VII-10 the decreases in sectoral outputs given foodgrains, vegetable oils, and cotton imports of 1339, 49, and 174 million rupees respectively is given. The total of the decreases in sector outputs resulting from the total 1562 million rupees is 1820 million rupees. Of this total, 1703 million rupees (97 percent) is attributed to the foodgrains, vegetable oils, and cotton sectors. However, keep in mind that part of that 97 percent is the impact of imports of one sector on the output of another sector. That is, foodgrain imports depress the output of vegetable oils and cotton, etc. The results of Table VII-7 and VII-10 can be compared to determine the impact of the vegetable oils and cotton imports. But because of the aggregation, the impacts of the vegetable oils and cotton imports cannot be distinguished. In Table VII-7 the impact of 1339 million rupees of imports of foodgrains on the vegetable oils and cotton sectors is given. Subtracting those values from their corresponding values given in Table VII-10 leaves the combined total impact of 228 million rupees on the cotton and vegetable oils sectors resulting from a combination of the cotton and vegetable oil imports. The difference of 287 million rupees between the total output decreases of Table VII-7 and Table VII-10 is the combined total impact of the 174 and 49 million rupees of cotton and vegetable oils respectively. Of that impact, 59 million rupees (21 percent) is on sectors other than vegetable oils and cotton themselves.

Table VII-10. Decrease in sectoral outputs because of 1339, 49 and 174 million rupees of imports of foodgrains, vegetable oils and cotton respectively[a] (million rupees, 1960-61 producer prices)

Sector		Decrease in output
1.	Construction	0.0
2.	Electrical equipment	7.141-3
3.	Non-electrical equipment	1.825-1
4.	Transport equipment	1.576
5.	Metal products	8.251-1
6.	Metals	7.276-1
7.	Minerals	2.412
8.	Rubber	6.623-2
9.	Consumer products	1.408-2
10.	Animal husbandry	5.250-2
11.	Flour milling	6.095-5
12.	Sugar	1.066-2
13.	Plantations	8.038-3
14.	Vegetable oils	49.169
15.	Vanaspati	2.379-2
16.	Starch	2.352-3
17.	Milk products	7.932-3
18.	Breweries and softdrinks	2.909-2
19.	Foodgrains	1474.690
20.	Cotton	179.422
21.	Cotton products	8.177-3
22.	Jute	1.862
23.	Other textiles	6.078-3
24.	Man made fibers	2.360-3
25.	Oil seeds	41.364
26.	Other crops	19.586
27.	Fertilizers	19.000
28.	Ceramics and bricks, etc.	1.632-5
29.	Glass and glass-wares	5.521-2
30.	Wood products	8.929-2
31.	Forest products	2.315-1
32.	Motor transport	0.0
33.	Petroleum	3.690
34.	Paper and paper products	2.748-2
35.	Other chemicals	1.868
36.	Insecticides and pesticides	1.926
37.	Railways	13.609
38.	Electricity	4.957
39.	Coal and coke	2.914

[a]The digits following the hyphens in the numbers are negative powers of ten by which the first four digits are multiplied.

The difference between the characteristics of the foodgrain impacts and the combined effects of the cotton and vegetable oil impacts needs consideration. Recall that 96 percent of the impacts of foodgrain imports were on the foodgrains sector. But only 79 percent of the vegetable oil and cotton import impacts occur in the vegetable oils and cotton sectors. Much of the remaining 21 percent was an impact on the oil seeds sector. The total negative impact of foodgrain and of the combination of vegetable oils and cotton imports was 114.6 percent and 128.7 percent of the aid respectively. The total impact of foodgrain imports on the foodgrains sector was 109.7 percent of the aid. In contrast, the total impact of the combined cotton and vegetable oil imports was only 102.3 percent on the cotton and vegetable oils sectors. The reason for the variance in the nature of the impacts resulting from the different imports is the degree of processing and manufacture embodied in the imports. The more nearly processed the imports are for consumption in final demand, the greater their interindustry impacts when they substitute for domestic production.

The Impacts of Aid with and without Structural Change

As a means of illustrating the effect of aid with and without a structural change the fertilizer coefficient for foodgrains is changed. Because data is not available for updating the entire foodgrains production sector, the effects of changing only one coefficient are derived. The coefficient calculated from the aggregated 39 x 39 table for 1964-65 is 0.01245. From that table it can be shown that 81 percent of the fertilizers available were used for foodgrains. The availability

of fertilizer nutrients was 674,000 and 1,948,000 metric tons respectively in 1964-65 and 1968-69 (16, p. 75). For the same years the production of foodgrains was 89,355,600 and 94,012,600 m.t. respectively (35, p. 59). Assuming that the ratio of all fertilizer available to the fertilizer applied to foodgrains remained constant at 81 percent, 546,000 m.t. and 1,577,880 m.t. of fertilizer were used for foodgrain production in 1964-65 and 1968-69 respectively. The ratio of m.t. of fertilizer per m.t. of foodgrains in 1964-65 and 1968-69 can be shown to be .00611 and .01678 respectively. Hence, the input-output coefficient of fertilizer for foodgrains increased by a multiple of 2.75 between 1964-65 and 1968-69. To show the impact of this technical change, the coefficient in the fertilizer row and foodgrains column can be changed from .01245 to .03424.

To show the effects of this technical change on the impacts of aid, the results of the impact of aid can be calculated both with and without the technical change. The analysis above on the effect of 1339 million rupees of foodgrains aid are given in Table VII-7. The effects of the aid with the changed input-output coefficient for fertilizer are shown in Table VII-11.

The change in the impact of foodgrain imports due to the structural change is indicated in Table VII-12. The column "difference" was derived by subtracting the second column of Table VII-7 from the second column of Table VII-11. Similarly, the column "ratio" was derived by dividing the second column of Table VII-11 by the second column of Table VII-7. A review of Table VII-12 yields interesting and somewhat surprising results. Recall Table VII-7 shows that a unit of foodgrain

Table VII-11. Decrease in sectoral outputs because of foodgrain imports given a structural change[a] (million rupees, 1960-61 producer prices)

Sector	Foodgrain imports 1339.0	Foodgrain imports 1.0
1. Construction	0.0	0.0
2. Electrical equipment	9.137-3	6.823-6
3. Non-electrical equipment	3.635-1	2.714-4
4. Transport equipment	1.555	1.161-3
5. Metal products	4.107-1	3.067-4
6. Metals	5.919-1	4.420-4
7. Minerals	6.837	4.770-3
8. Rubber	6.902-2	5.155-5
9. Consumer products	3.604-2	2.691-5
10. Animal husbandry	1.318-1	9.842-5
11. Flour milling	1.443-4	1.078-7
12. Sugar	1.679-2	1.254-5
13. Plantations	8.377-3	6.256-6
14. Vegetable oils	3.168-1	2.366-4
15. Vanaspati	4.414-2	3.297-5
16. Starch	5.153-3	3.848-6
17. Milk products	1.472-2	1.099-5
18. Breweries and softdrinks	3.042-2	2.272-5
19. Foodgrains	1468.326	1.097
20. Cotton	2.200-2	1.643-5
21. Cotton products	1.494-2	1.116-5
22. Jute	4.473	3.340-3
23. Other textiles	6.587-3	4.919-6
24. Man made fibers	3.842-3	2.869-6
25. Oil seeds	2.665-1	1.991-4
26. Other crops	17.268	1.290-2
27. Fertilizers	50.710	3.787-2
28. Ceramics and bricks, etc.	2.088-5	1.559-8
29. Glass and glass-wares	1.139-1	8.509-5
30. Wood products	1.074-1	8.022-5
31. Forest products	4.204-1	3.140-4
32. Motor transport	0.0	0.0
33. Petroleum	3.725	2.782-3
34. Paper and paper products	4.985-2	3.723-5
35. Other chemicals	3.464	2.587-3
36. Insecticides and pesticides	1.655	1.236-3
37. Railways	13.420	1.002-2
38. Electricity	6.640	4.959-3
39. Coal and coke	4.932	3.683-3

[a]The digits following the hyphens in the numbers are negative powers of ten by which the first four digits are multiplied.

Table VII-12. Difference and ratio of outputs resulting from imports with and without structural change[a] (million rupees, 1960-61 producer prices)

Sector	Difference[b]	Rank	Ratio	Rank
1. Construction	0.0	1	0.0	1
2. Electrical equipment	2.703-6	10	1.656	17
3. Non-electrical equipment	1.528-4	29	2.288	23
4. Transport equipment	2.994-4	31	1.347	10
5. Metal products	6.763-5	25	1.283	8
6. Metals	1.317-4	27	1.425	13
7. Minerals	3.030-3	38	2.742	37
8. Rubber	1.504	16	1.412	12
9. Consumer products	1.686	17	2.678	35
10. Animal husbandry	6.176-5	24	2.684	36
11. Flour milling	6.6378	4	2.603	33
12. Sugar	6.110	12	1.950	19
13. Plantations	1.825-6	7	1.412	11
14. Vegetable oils	1.368-4	28	2.369	28
15. Vanaspati	1.900-5	18	2.360	26
16. Starch	2.371-6	8	2.605	34
17. Milk products	6.334-6	14	2.360	27
18. Breweries and softdrinks	4.381-6	11	1.239	7
19. Foodgrains	4.959-5	22	1.000	3
20. Cotton	9.628-6	15	2.415	30
21. Cotton products	6.169-6	13	2.237	22
22. Jute	2.124-3	36	2.747	38
23. Other textiles	1.545-6	6	1.458	14
24. Man made fibers	1.506-6	5	2.105	21
25. Oil seeds	1.151-4	26	2.369	29
26. Other crops	4.462-5	21	1.003	5
27. Fertilizers	2.410-2	39	2.750	39
28. Ceramics and bricks, etc.	6.176-9	3	1.656	18
29. Glass and glass-wares	5.041-5	23	2-453	31
30. Wood products	2.623-5	20	1.486	15
31. Forest products	1.880-4	30	2.493	32
32. Motor transport	0.0	2	0.0	2
33. Petroleum	3.916-4	32	1.164	6
34. Paper and paper products	2.119-5	19	2.322	24
35. Other chemicals	1.491-3	33	2.359	25
36. Insecticides and pesticides	2.593-6	9	1.002	4
37. Railways	2.579-3	37	1.347	9
38. Electricity	1.700-3	34	1.522	16
39. Coal and Coke	1.834-3	35	2.036	20

[a]Imports consist of one million rupees of foodgrains in 1960-61 producer prices.

[b]The digits following the hyphens in the numbers are negative powers of ten by which the first four digits are multiplied.

imports has by far the greatest impact, a 1.097 unit decrease, on the output of the foodgrains sector. The impact of a unit of foodgrain imports given the structural change (Table VII-11) is a decrease in the output of foodgrains of 1.097 units. That appears to be identical to the impact without structural change, however that is because of rounding the numbers to four digits. The actual difference is 0.00004959 or only about 50 per 1,000,000 rupees of imports. This is so small that if account could be taken of significant digits, there may not in fact be any difference.[1]

The same situation does not, however, exist for all 39 sectors. Table VII-12 shows that the greatest difference in the before and after structural change impact of imports is for fertilizer, sector 27. Before the structural change, imports of 1,000,000 rupees of foodgrains result in a 13,770 rupees decrease in fertilizer output. After the structural change the same imports result in a 37,870 rupees decrease of fertilizer output. Not unexpectedly the ratio column of Table VII-12 shows the structural change causes a 275 percent increase in the impact of foodgrain imports on fertilizer output. Other results of the change are not so obvious. For example, the impact of foodgrain imports on the jute sector, 22, was much more effected by the structural change than was the impact on the foodgrains sector itself. This was true for other sectors as well as for fertilizer and jute.

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[1] It may be well at this time to note that the matrix inversions were done with a double precision procedure on the computer.

Table VII-12 shows that 17 of the 39 sectors have a larger additional decrease because of foodgrain imports with structural change than does the foodgrains sector itself. On a relative basis the change is even more striking. Relatively 36 of the 39 sectors have a larger additional decrease because of foodgrain imports with structural change than does the foodgrains sector itself. The only two sectors which register smaller relative impacts are construction and motor transport, which always have been uneffected because all of their demand is final demand as shown by Table VII-2. The implication of this analysis is that when structural change occurs, the change in the impact on sectoral output due to imports is substantially greater for sectors other than the sector producing commodities similar to the imports.

The comparison of the foodgrains sector to the mean of all sectors is again striking. The mean difference for all sectors given in Table VII-12 is 993 per 1,000,000 rupees of foodgrain imports. For foodgrains it is only 50. The mean ratio for all sectors given in Table VII-12 is 1.85 while for foodgrains it is 1.00. Hence, the change in the impact caused by foodgrain imports on the output of the "average" sector is much greater than the change in the impact on the foodgrains sector itself. The negative impact on the foodgrains sector was only 50 rupees per million rupees of foodgrain imports. But the total increase in the negative impact for all sectors was 38,732 rupees. If only additional decreases in output of the foodgrains sector are taken into account, by far the greater part of all additional decreases are ignored.

The nature of the structural change is important. In the illustration above, the fertilizer input into foodgrains was increased. This change was analyzed given the import of foodgrains. The impact of imports displacing domestic production is to reduce the output of the sectors of the importing economy which directly or indirectly provide inputs into the sector whose output is displaced by imports. Imports displace domestic production when final demand is fixed and imports increase. The result of increasing the input of fertilizer into foodgrains was to intensify the depression of the output of the sectors. If the input of fertilizer into foodgrains would have decreased rather than increased, the ranking of the sectors by impact change would be the same. However, the direction of the change in the impacts would have been reversed. That is, instead of intensifying the decrease in sector outputs, the structural change would have reduced the decreases.

Structural changes occur with time. Hence, if the impacts of imports on the economy are considered at different points in time it is essential to consider all the sectors of the economy and not just the ones whose output corresponds to the commodities imported. Since commodity aid is a special case of imports, this analysis also has implications for aid imports. Consider the case of P.L. 480 imports to India. One emphasis of this study has been on the need to inquire into the effects of aid beyond the sector of the recipient economy which produces commodities similar to that received as aid. This is contrary to the historical bias of commodity aid studies. During periods of little or no structural change in the recipient economy, the sectoral output

decreases due to commodity aid imports will be relatively constant. But over time when there is structural change, these sectoral output decreases may be greatly enlarged or reduced. The group of sectors which undergo the greatest enlargement or reduction of their output decreases may not include the sector producing commodities similar to those of the aid.

As economic development occurs the tendency is for the several sectors of the economy to become more interdependent. In Chapter VI the effects of high-yielding wheat on inputs into wheat production were shown. Table VII-2 which gives the intersectoral flows for India for 1964-65 does not have a wheat sector but wheat is a significant part of the foodgrain sector. It is seen from column 19 that there is not a large dependence of foodgrains on other sectors. In fact the dependence is much less than is implied by the farm management studies for wheat in the Punjab discussed above. The backward linkage, $100 \sum_{i=1}^{n} \frac{Q_{i20}}{q_{20}}$, shown by the flow table is 12. In contrast Table VI-1 shows that the seed; manure and fertilizer; machinery, buildings, implements, and interest on fixed capital; insecticides and pesticides; and irrigation comprised 15.6 percent and 30.2 percent of the total inputs for wheat in Punjab in 1955-56 and 1969-70, respectively. Since most of these inputs are purchased from other sectors, the backward linkage for wheat production in the Punjab is rising.

The limitations of the above empirical analysis of structural change must be kept in mind. The entire analysis is viewed as a realistic

illustration. However, only one structural change was made in the entire interindustry matrix. Changes resulting from economic development generally make the sectors more interdependent. The structural change considered above increased the dependence of foodgrains on fertilizers. Hence, the implication is that the consideration of only one structural change biased the results downward relative to reality. Of the total 1,185,000 rupees production decrease from all sectors with the structural change, 1,097,000 or 93 percent is because of the decrease in the output of foodgrains. In contrast, 96 percent of the total decrease in production without the structural change is accounted for by the foodgrains sector, as shown above. Essentially all of this change from 96 percent to 93 percent is because of the increased loss of output of sectors other than foodgrains. Since, in reality, the effects resulting from structural change were probably greater than those considered, it may be that by 1970 10 percent or more of the negative impacts on output stemmed from sectors other than foodgrains. Another limit to this analysis of structural change is that final demand may not remain fixed. As shown in Chapter V, only special policies to expand final demand will succeed in completely offsetting the negative impacts of aid imports on production.

CHAPTER VIII. CONCLUSIONS

Summary

The objective of this study has been to broaden the scope of the analysis of foreign aid in commodity form. Historically, the analysis of negative impacts resulting from commodity aid has concentrated almost exclusively on the same sector as the commodity donated. This study has illustrated with an input-output table for India that aid can have significant effects on other sectors. The designs of several policies for the elimination of the negative effects of aid have been investigated. Programs previously proposed only alleviate the negative effects of aid. A new program has been presented to eliminate them. It requires an adept use of a differentiated market.

All commodity aid is an import. Based upon the input-output model, imports are divided into a four class, two-way classification scheme. This division is based on their utilization and their competition. The two types of utilization are consumption in final demand and consumption as an input into other production. The two types of competition are competing and non-competing imports. Both commercial and aid imports fit the classification. Although not all foreign aid is commodity aid, it is likely that most foreign aid, regardless of its form, will ultimately be commodity imports. Hence, the analysis has wider implications than for just aid originating in commodity form.

The methods of analyzing the four classes of imports with the input-output system have been developed. One conclusion reached for all imports is that either they substitute for domestic output, substitute

for other imports, or satisfy an increased demand. Input-output methods have been developed for analyzing these three possibilities. The impacts of aid are measured in output and final demand changes of the several sectors. Methods are also given for calculating the effects of imports with policy constraints on output for final demand. Two types of demand expansion are possible. They are the direct expansion of final demand and the indirect expansion of final demand through an increased intermediate demand.

The input-output method is limited by its lack of prices. A major controversy of commodity aid has been its depressive effect on the domestic production of the aid commodity. Input-output analysis measures those effects with constant prices. Theory stipulates that both price and quantity effects must be employed. However, a model which permits both price and quantity to be endogenous in many sectors is very difficult if not impossible to apply empirically. The remaining alternative, to keep output constant and measure price changes, has not been pursued.

One of the objectives of this study has been to measure the effects of aid. Another has been to eliminate the negative effects, i.e., those which impose losses and prevent a pareto optimum. Discovering where a loss is imposed and accurately measuring its effects require the inclusion of price analysis. Therefore, the input-output assumption of constant prices has been dropped and the effects of aid have been discussed in a more general analytical framework. A special composite commodity was defined to simplify the analysis while keeping it comprehensive. Four basic approaches have been investigated for

measuring and eliminating the negative effects of commodity aid. They are (1) resource compensation, (2) price maintenance when aid is sold in the commercial market, (3) demand expansion through a differentiated market, and (4) a new approach to demand expansion through a differentiated market.

It is argued a resource compensation policy fails because identification of the losses is a hopelessly complex task. Perhaps it could be accomplished by a subsidized resource retirement program. However, the implications of idle resources in a country receiving aid is probably unacceptable. Besides, large administrative problems would still exist.

A policy to subsidize the prices of the aid commodity and the other commodities which fall as a result of aid depends on many factors. Among them are the price paid the donor for the aid, the equilibrium prices which exist with and without aid, and the demand price elasticities of these commodities. The conditions necessary for such a price subsidy policy to be self-financing have been investigated. If such a program results in a net revenue, then demand price elasticity of the aid commodity must be greater than unity and the following conditions exist. First, no resources leave the production of the aid commodity. Second, all other commodities have a zero cross price elasticity for the aid commodity. Last, the aid is a pure grant. These conditions are very demanding. It is concluded that programs to enact such a policy are not an acceptable means of measuring and eliminating the negative effects of aid.

Any sale of the commodity at less than the free market equilibrium price is considered to constitute a differentiated market. Selling all

the aid through a differentiated market expands demand through an income effect. However, it has been shown that even if all the aid is distributed gratis, it is impossible to expand demand enough to eliminate all the negative effects of aid substituting for commercial transactions.

A new approach to demand expansion has been developed. It relies on the fact that distribution through a differentiated market has an income effect resulting in demand expansion. Its mechanism is simple but quite powerful for commodities such as food in less developed countries which have a relatively high income elasticity. Let the quantity of aid be F and the ratio of the quantity flowing through the differentiated market to the increase in demand which results be 1 - r. Then it has been shown that procuring $\frac{rF}{1 - r}$ of the commodity in the domestic market and distributing it and the aid through the differentiated market will result in a demand expansion of F. The demand of the commodities similar to the aid commodity can also be expanded to prevent negative effects through their prices. It is shown that the costs of eliminating all the negative effects of the aid may be sufficiently small to leave a substantial proportion of the aid for other purposes. This analysis is applied to the Rogers' study of cereals in India (56). The Indians appear to have unknowingly illustrated the success of such a method, although they failed to expand demand by as much as the aid. Rogers shows that aid displaces the commercial market only to the extent of 7 percent of the quantity of aid. The formulation shows that without distributing some of their domestic production through the fair price

shops, Rogers would have obtained the results of 25.6 percent. That is, by a clever use of the fair price shops 73 percent more of the displacement of domestic production was eliminated than would have been under the usual procedure of distributing only aid through the differentiated market. Thus, the major portion of the success of distribution through the fair price shops has resulted from an application of this formulation of demand expansion.

The literature of commodity aid suggests that as long as counterpart funds are spent concurrently with the sale of the aid, the monetary effects are neutral. This argument has been shown to be false because at least one price must decline because of the increased supply of real goods, given a constant money supply. The decline in the price level cannot be taken as conclusive evidence that the aid is deflationary because real income and real balance effects will tend to offset the price decline.

An input-output table for India is used to demonstrate some of the applications of input-output suggested for aid analysis. The analysis shows, as would be expected, that much of the impact of the aid is on the domestic competing sector. However, it also shows that there can be substantial effects on the other sectors. Of all the negative impacts of aid resulting from foodgrain imports, 3 percent were transmitted beyond the foodgrains sector. Similarly, 21 percent of the total combined effects of cotton and vegetable oils were transmitted beyond the cotton and vegetable oils sectors. Consequently, the total gross negative effects of cotton and vegetable oil imports was 128.7 percent of the aid. In contrast, the total gross negative effects of foodgrain

imports was only 114.6 percent of the aid. A major impact of the vegetable oils is on the oil seeds sector. Hence, the more processing embodied in the aid commodities, the greater the total and interindustry negative effects if aid displaces domestic production. These effects beyond the sector competitive with the aid commodity may appear small. In some circumstances they may be relatively unimportant. However, if the aid is not a pure grant, the importance of the negative effects increases because a given oversight in the cost resulting from them is not as easily overcome by the benefits.

The most striking results of the empirical multisectoral analyses derive from considering aid with and without a structural change. The fertilizer-foodgrains input coefficient was increased to 275 percent of its original level to simulate the actual increase of fertilizer inputs into foodgrains in India between 1964-65 and 1969-70. All other parts of the input-output matrix remained the same. The change in the impacts of aid on the outputs of the several sectors was less for the foodgrains sector than for many others. In fact, of the 39 sectors, 17 had a greater absolute change and 36 a greater relative change in the impact of aid on their outputs than did the foodgrains sector. The percentage of the total impact which occurred in the foodgrains sector fell from 96 percent to 93 percent. The implication is that over time, structural changes substantially shift the sectoral location of the impacts of aid. Only one coefficient was changed; however, farm management studies for wheat in India show that the "green revolution" is greatly increasing the percentage of inputs farmers are likely to purchase from other sectors. This means that as India undergoes the

"green revolution" food aid will become less valuable not only because India is increasing her own food supplies but also because the negative effects of food aid will rise.

Policy Implications

Multisectoral analysis has important implications for policies which regulate commodity aid. When the output of one sector declines, others do also, as has been shown empirically for India. Consequently, the best policy formulation for aid derives from an overview of the economy as well as intricate studies of its several sectors.

A wide range of proposals exist to use the commodity aid itself for welfare and investment purposes (56, pp. 150-198). Welfare programs encompass distribution for famine or disaster relief, to low income groups such as senior citizens and the handicapped, and to groups with special nutritional needs such as children and pregnant women. Investment programs include wages-in-kind programs and generation of revenue from selling the aid. It has been the policy to consider a wide range of alternatives for the investment of these funds. This is evidenced by the statutory limits placed on the use of local currencies generated by P.L. 480. The approved uses include programs for education, health, internal and external security, multilateral trade, and general economic development in addition to programs for the development of agricultural production (30, pp. 45-46). It appears that maximizing gross benefits from aid have not been significantly limited by the absence of alternative uses of aid.

Unfortunately, the gross losses imposed by commodity aid in the recipient country have not been analyzed with a similarly broad view. Policy on the losses imposed by the aid has concentrated almost without exception on the sector competitive with the aid. This study has shown that such a narrow view is inadequate. The sectors of an economy are interdependent and the losses do not end with a single sector. The measurement and control of the losses imposed by aid must employ policies which go beyond a single sector.

The negative effects of aid depend on the nature of the commodity and its means of distribution in the recipient country. The more processing and manufacturing contained in the aid commodity upon its receipt, the greater its total gross and intersectoral negative effects if it substitutes for domestic production. Hence, if donors wish to minimize the negative effects of aid which substitute for domestic production, they must provide commodities with a minimum amount of processing embodied in them.

Previously, policies have been proposed which will alleviate the negative effects of commodity aid. A new policy has been suggested which can completely dispel the negative effects of aid. In fact, it could be used to more than compensate for the aid in order to stimulate development of domestic production. It employs a mechanism of buying appropriate quantities of the aid commodity in the recipient's commercial market and distributing those quantities along with the aid in a differentiated market. The policy is generally self-financing and would raise revenues for use in other programs.

The use of a program which effects such a policy accomplishes three goals. They are (1) a measure of the negative effects of aid as shown by the program's cost, (2) the compensation of the losses imposed by the aid, and (3) an efficient means of distributing aid while accomplishing the previous two goals. The correct decision of the level of aid requires the accomplishment of the first goal but not the second. The second goal is a policy question of income distribution and economic development. However, in reality it may be impossible to accurately estimate the costs without actually paying them. Then it would be best to pay them and acquire an accurate measure of the effects of aid needed for a correct decision on the quantity of aid. The desired welfare and development goals may be instituted with other policy programs.

The form of the differentiated market depends on whether aid is to be used for welfare or investment programs. The differentiated market may take any form desired for welfare purposes. However, the greater the welfare gains from distributing the aid gratis or at a low price, the greater the costs of the programs and the smaller the net revenue available for government investment programs. The use of multisectoral analysis suggests that it may be desirable to design the differentiated market for demand expansion in more sectors than just the one associated with the aid commodity. This can be accomplished by procuring goods from these other sectors in the recipients commercial markets and distributing them through the differentiated market.

The monetary effects of aid cannot be assumed to be neutral even when there are no income redistribution effects and the sale proceeds

are spent immediately upon their receipt. This means the monetary authorities must be aware of the commodity aid and adjust for it. The larger monetary impacts are likely to be income redistribution as a result of the expenditure of the sale proceeds and hoarding of the sale proceeds especially in the case of P.L. 480 counterpart funds. The hoarding may or may not occur in a fashion which results in deflation. If proceeds are hoarded in accounts which expand the money supply they are not net hoards. Even if there are no income redistribution effects, the quantity of funds hoarded in accounts which do not expand the money supply cannot be used as a precise measure of the deflationary effects. This is because the effects may not be neutral even if there were no hoarding and income redistribution effects.

It is often argued that aid ought to be provided to permit a less developed country to attain self-sustaining growth. For example, food aid ought to be provided and even used to promote the attainment of self-sufficiency in food production. The implication is that aid can then be stopped. This study supports that view because it shows that the cost of aid in terms of its multisectoral negative impacts is likely to rise as development occurs. Development increases the interdependence of the several sectors and hence the negative impacts become greater and more widely spread throughout the economy. As development occurs, not only does the need for aid become less crucial but its cost in terms of its negative effects also rises.

Lastly, more information on price elasticities and supply-demand relationships would improve the analysis of aid. But this study shows that a plea for using multisectoral methods, for which data may

already be available, is in order. Though each have their limitations, it is hoped that time will find a larger place for more multisectoral studies of commodity aid. The approach to a multisectoral econometric model may be as much through multisectoral as through econometric studies. In any case, final demand is crucial for effective commodity aid which competes with domestic production and it has been argued that the analysis through input-output complements demand expansion of a single sector.

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